RAILROAD GAZETTE

FRIDAY, DECEMBER 28.

CONTENTS.

Contributions.

Depreciation of Railroad Securities.

TO THE EDITOR OF THE RAILROAD GAZETTE:

For a conservative journal it seems to me you may almost be said to jump at conclusions sometimes. It is rather presumptuous for a layman to question your reasoning, but some of your criticisms of Judge Cooley's report fairly take one's breath away, their compass is so vast. In the paper of Dec. 7 you attribute a falling off of 3¾ millions in Manitoba stock to the prohibition of pooling. The Central Pacific, having a perfect monopoly, loses 4½ millions, and you attribute that to the same cause. Is this not just a trifle absurd? The New York Central has lost, but the Lake Shore has gained. Do not these facts offset each other so far as the effect of the law is concerned? I believe the lack of export demand for grain and the large number of Lake vessels carrying wheat and corn have kept down rates with far more effect than any question of agreement between the trunk lines. If the Inter-state law has really caused a loss of 216 millions of dollars it is your duty to preach it in the highways and by-ways day and night until the Western grangers know the truth. When railroad contractors, and construction companies composed of directors, are making their millions out of railroad building, is it not natural for not only grangers but all reasonable people to put their faith rather in Judge Cooley's claim that stocks are simply getting down toward their normal standard? Again, take those roads west of Chicago; they would have fought in any event. Prohibition of pooling gives them a plausible fictitious excuse for not agreeing, but it cannot be called a *cause*. Mr. Adams is right; if they had a spark of honor they could agree on differential rates. You might as well repeal the laws against house breaking because burglary is not repressed as to try to formulate any law to help those born sharpers maintain rates to St. Paul and to Kansas City.

Your views as to railroad building are still more visionary. Of course all agree that there has been too much of it, and it may be admitted that, as you say, managers who know they will not be allowed to combine will desire to build branches so as to compete with their neighbors; but have they done so, actually? Has any important road made extensions because they could not compromise with their competitors? The Atchison built into Chicago simply because they believed the increase of population west of the Missouri would warrant their having a line to Chicago. The feeling of independence and ambitious desires of self-aggrandizement in railroad magnates have completely overshadowed all other influences. Much of the new line built has been to develop mines, etc., at the south and elsewhere, and is legitimate. A great share of it was projected before the passage of the Inter-state law.

The New York *Evening Post*, which seems to agree with you in general, has, I believe, stated the matter more fairly. They attribute different views to different standpoints of the observer. By taking an extreme view and looking ten years into the future your hypothesis may be correct, but as things now appear Messrs. Adams and Cooley seem to hold the most rational position. The law in its tendencies is quite likely wrong in some respects, but why blame it before it has hurt anybody? PLAYFAIR.

[We have treated this matter at some length on the editorial page. We only note here that some of the conclusions which we are "almost said to jump at," have their origin in the mind of our correspondent rather than in the article itself.—EDITOR RAILROAD GAZETTE.]

The Contracting Chill in Wheel Making—New York Railroad Club.

At the regular meeting of the New York Railroad Club, Dec. 20, Mr. J. N. Barr, Superintendent of Motive Power Chicago, Milwaukee & St. Paul, presented the following paper on

CAST-IRON CAR WHEELS.

In maintaining the wheel equipment of a railroad and noting the large sums expended for this item alone, the variable service obtained from wheels, the tendency to breakage, the increasing capacity of rolling stock and speed of trains, the officers of a road who are responsible for the safety of trains and for the economical maintainance of the same must often be sorely perplexed as the following questions arise:

Are the wheels strong enough to afford reasonable assurance against breakage?

Could we with safety buy a cheaper wheel or should we buy a more expensive one?

Are the wheels of such a character as to give good mileage results, and might not improvements be made?

Are the wheels in service so treated as to secure the best and most economical results?

The writer is inclined to believe that, with an adequate conception of what constitutes a good wheel, with proper inspection and tests, and adequate wheel records, the above questions may always be definitely answered.

In order to present the matter in a systematic form it will be taken up in the following order:

Description of a perfect wheel; variations from a perfect wheel as found in practice; causes of such variations; inspection and tests to which wheels should be subjected; how wheels fail in service; wheel records and what they should teach; mileage results.

A perfect wheel should answer to the following description:

1. The tread should be perfectly cylindrical.

2. The tread and inside of flange should be perfectly smooth and free from any defect that would impair the integrity and homogeneousness of the metal forming the parts subject to abrasion, and should conform in outline to the chill.

3. The body of the wheel should be sound and smooth and free from any of the defects usually seen in the castings.

4. The wheel when broken should show a shell of white iron extending inward from the parts subject to abrasion, not less than three-eighths of an inch, nor more than three-fourths of an inch, and this shell should not vary in thickness in the same wheel.

5. There should not be a distinct line of demarcation between the white and gray iron, neither should the gradation from white to gray be very undecided.

6. The gray iron forming the body of the wheel should be of medium grain, dark color, a ragged fracture, free from imperfections or white iron.

In practice wheels never realize the above description, their perfection being more or less impaired by the following defects.

1. Chill cracks. 2. Rough treads. 3. Slag in tread. 4. Sweat and depression at throat. 5. Irregular depth of white iron. 6. Too great or too small depth of white iron. 7. Lack of roundness.

There are other defects which are also common to general castings but they will not be discussed here.

The mold in which car wheels are cast consists in general of an iron ring shaped on the inside to form the tread and inside of the flange. The remaining part of the mould is composed of sand, as for ordinary castings. The iron ring, or chill as it is called, causes the molten metal to cool rapidly, forming white iron, and it is on the depth, hardness and perfection of this shell of white iron that the durability of the wheel depends. In order to fully appreciate the character and importance of the defects mentioned above, a definite idea should be obtained of what takes place as a car wheel mold is filled with molten metal.

The operation of pouring a wheel and the behavior of the molten metal in the chill may be described as follows: The molten metal enters at the hub, spreads over the sand forming the bottom part of the mold, thence through the depressions in the sand which form the brackets, into the flange. When the molten metal rises to a level with the point of the flange, it first comes in contact with the chill. It then gradually rises, covering the inside of the flange, the throat and finally the tread, until the mold is filled. The length of time consumed in pouring varies from 20 to 30 seconds, sometimes falling below the minimum mentioned, and sometimes exceeding the maximum. In general an interval from 10 to 15 seconds occurs between the time when the molten metal first touches the chill and the time when the chill is entirely covered. Numerous experiments have been made which show that when molten metal is poured against a chill, a contact of 10 seconds is sufficient to form a solid shell nearly one-fourth of an inch in thickness. We have then in the ordinary process of pouring a wheel, at the instant the mold is filled, the following condition of things: A shell of metal nearly one-fourth of an inch in thickness has been formed against the flange portion of the chill, and this gradually decreases until at the top of the chill the shell is just beginning to form. This shell as soon, as it forms, starts to shrink. The chill is rapidly abstracting heat from the molten metal and starts to expand.

The body of the wheel is composed of molten metal which exerts an outward pressure against the tender red hot shell of metal which has solidified against the chill and resists its contraction. The shell of metal formed against the chill gradually thickens and contracts, the chill itself expands and the body of the wheel solidifies. In the operation described above it is more than likely that before the shell formed against the chill has reached an average thickness of one-quarter inch, entire separation has taken place between the chill and the shell, and the hardening influence of the chill is no longer felt. The above-described operation should be carefully borne in mind, as on it depend either directly or indirectly nearly all the defects peculiar to wheels, which will now be more fully discussed.

Chill Cracks.—This defect makes its appearance as a crack across the tread or flange or across both. It is believed that a chill crack in the flange, is caused by severe contraction in much the same way as a thin plate of hot metal is cracked by the application of water. The chill crack across the tread is caused by the pressnre of the molten metal composing the body of the wheels against the tender red-hot shell of metal which first forms against the chill. In its origin it is properly a tear. Wheels having this defect are rarely seen in service, as it is considered a sufficient ground for scrapping on the foundry inspection. Hot and fast pouring increases the tendency to chill cracks. Cold and slow pouring prevents them. It is, I believe, universally conceded that the hotter and faster a wheel is poured, the better the quality, material being the same, and the principal skill of the wheel molder consists in pouring his metal as hot and as fast as possible without incurring too great a loss from chill cracks. In the endeavor to avoid chill cracks, there is a constant tendency on the part of the molder to slow and cold pouring. This leads to the production and aggravation of the defects termed rough tread, slag in tread, sweat and depression in throat and irregular depth of white iron.

Rough Tread is caused by undulation and bubbling of the molten metal against the chill. It shades off from being so serious as to condemn the wheel, to waves and seams that are almost imperceptible. Pouring the metal at a very high temperature and very fast reduces this trouble to a minimum, cold and slow pouring aggravates it.

Slag in tread occurs in general as small depressed spots with a minute cavity in the centre. In wheels of ordinary good quality, it is a defect that is not at all prominent. It is also aggravated by cold and slow pouring, and reduced by hot and fast pouring. Rough treads and slag in tread indicate lack of homogeneity in the shell of white iron and are the primary causes of its disintegration in service.

Sweat appears as beads in the throat. Its cause is explained as follows: The shell of the metal solidifying against the inside of the flange commences to contract before the pouring of the wheel is completed. In shrinking it carries with it the thinner shell forming against the throat. The molten metal so nearly remelts the shell forming at the throat that it issues through in drops. Very slow pouring aggravates this defect, and fast pouring entirely prevents it. Sweat is a sure indication that where it occurs the depth of white iron is very much less than on other parts of the wheel. The depression in the throat in general extends nearly around the entire tread of the wheel; it is most decided in wheels showing sweat, and is deepest where the sweat occurs. This depression may be observed on wheels in service, which often run many miles before wearing smooth in the throat. The more decided the depression the greater the discrepancy between the depth of white iron in the throat and in the middle of the tread.

Irregular depth of white iron has a most serious influence on the service of wheels. It is caused by irregular separation between the chill and the wheel. Experiments demonstrate that if a block of cast iron be formed against a chill, and the chill removed in less than 40 seconds, the depth of white iron will be less than if the chill were allowed to remain until the block had cooled. Many measurements made of the depth of white iron on wheels, and of plain chilled blocks of the same metal, show that the maximum and minimum depth of white iron, measured at the middle of the tread, is 70 per cent and 50 per cent. respectively of that of the block, and measured at the throat is 50 per cent. and 33 per cent. of the same. The decreased depth of white iron on the wheel, as compared with the plain block, is due to separation between the chill and the wheel before the chilling operation is completed; the variation around the tread to earlier separation at some points than at others. This trouble is very much increased by slow pouring.

Too great or too small depth of white iron is a matter of the chilling quality of the metal used, although it can be modified, as shown above, by the manner of pouring. In the first case, brittle and unsafe wheels are produced; in the other, wheels which are deficient in durability.

Lack of roundness is a defect which of late years has attracted a great deal of attention, and is growing in importance as capacity of cars and speed of trains increase. It is caused by lack of roundness in the chill, irregular expansion of the chill and irregular contraction of the wheel.

To recapitulate, the following circumstances continually militate against the production of a perfect wheel: First, the tendency to chill crack, forcing the molder to pour molten metal at too low a temperature and too slow. Second, slow and cold pouring produces rough treads, slag in tread, sweat, lack of uniformity in the depth of white iron. Third, the expansion of the chill and the contraction of the wheel produces lack of roundness, variation in chill and a reduction in depth of white iron as compared with the normal chilling qualities of the iron used. In order to obviate and reduce as much as possible the difficulties peculiar to wheel-making described above, the writer has devised what is now generally known as the contracting chill. Its construction is shown in the accompanying drawing and may be described briefly as follows:

THE BARR CONTRACTING CHILL.

The ring which constitutes the ordinary chill is divided into 96 sections by radial divisions. These sections or blocks are held in position by an outside ring which is capable of being expanded or contracted, thus causing the blocks composing the chill to be moved radially outward or inward. By this means the expansion which occurs in the ordinary chill is entirely prevented, and the inward radial motion of the chill blocks is such as to extend the time of contact between the chill and the contracting wheel within, until nearly the full effect of the cooling influence of the chill is obtained. The expansion and contraction of the outside hollow retaining ring is effected by introducing steam or cold water. A precisely similar result would be obtained by replacing the hollow ring by a mechanical chuck.

The operation of the chill is as follows: When the molder is nearly ready to pour his metal, steam is turned on through the outer ring, causing it to expand and carrying with it the chill blocks, thus increasing the diameter of the chilling surface. When the molder commences to pour the molten metal, the steam is turned off and a current of cold water is passed through the ring, which causes a contraction of the outside hollow sustaining ring and a consequent decrease in the diameter of the chilling surface. The results obtained from the use of this device, as compared with the ordinary chill, are as follows:

Chill cracks are entirely prevented. In the past five months 15,288 wheels were made in these chills and not one was chill-cracked.

The restraints imposed by chill cracks being removed, the time of pouring has been decreased from between 20 and 25 seconds to an average of less than 10 seconds, and the temperature at which the molten metal is poured has been increased, so that practically no cooling or tempering of the metal whatever is required.

There is an entire absence of rough treads and sweat, and the presence of slag is almost entirely prevented.

There is a decided improvement in the depth of white iron and in its uniformity around the tread, the average variation around the tread being about one-sixteenth of an inch.

The quality of the gray iron, its freedom from slag or imperfections and the general strength of the wheel is enhanced by the hotter and faster pouring which is made possible by the use of this device.

The greater and more uniform depth of white iron on the tread affords an opportunity for truing up wheels with flat spots caused by sliding, or with treads made hollow by wear at a small fraction of the cost of a new wheel.

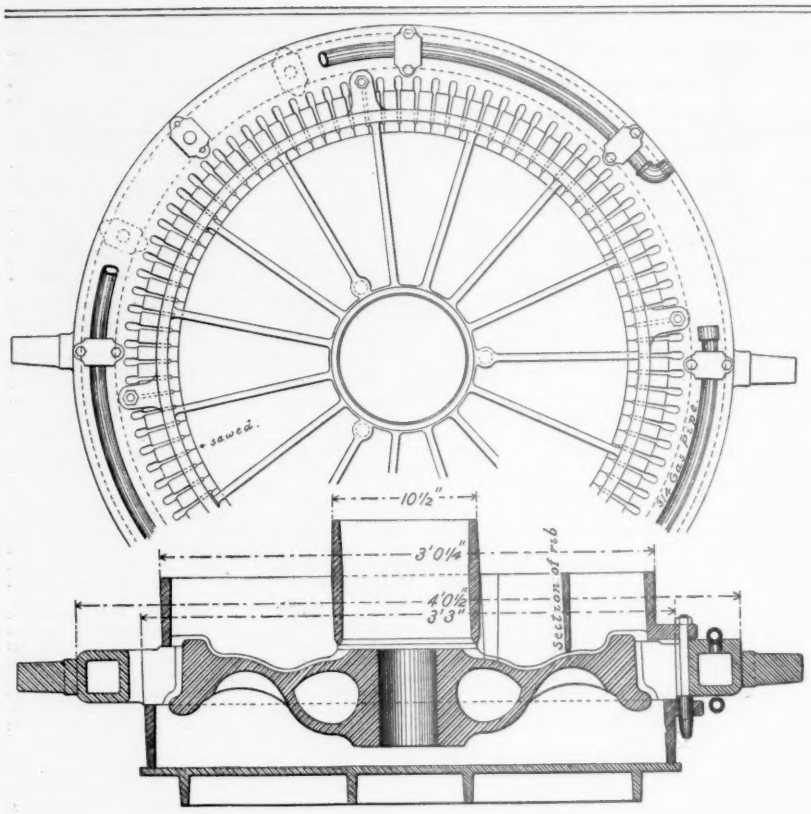
The actual mileage results obtained from these wheels show a very decided improvement as compared with wheels of the same material made in the ordinary chill. To illustrate: The Chicago, Milwaukee & St. Paul commenced the use of contracting chill wheels in small quantities in the latter part of 1885. The mileage obtained from all wheels scrapped, except those made flat by sliding, that were in service under cars in passenger trains, is as follows:

	Wheels drawn.	Average mileage.
1885	1,676	45,731
1886	1,058	70,468
1887	889	85,053
1888 (10 months)	686	98,024

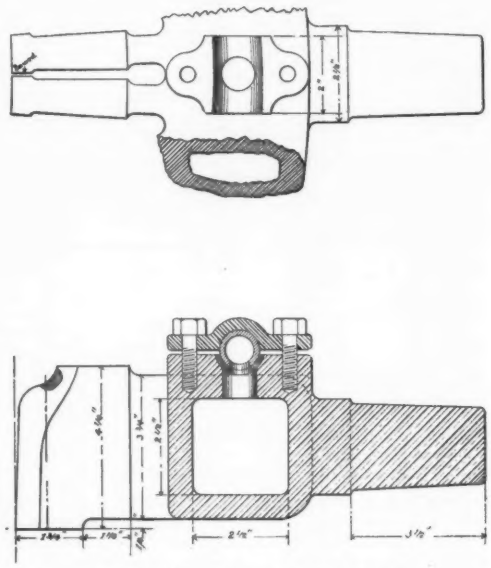
The average mileage made in 1885 is abnormally low, and it would not be fair to maintain that the use of the contracting chill had effected an increase of from 45,000 miles in 1885 to 98,000 miles, or more than twice as great, in 1888. Statement No. 1, accompanying this report shows, however, that from June to October inclusive the average mileage is considerably more than 100,000 miles, and the probabilities are that when the old common wheel is entirely removed from service the records will show at least twice as great a mileage as is shown by wheels of the same quality made in the common chill.

The wheels are almost perfectly round, and maintain this roundness in service.

There is one objection to the contracting chill wheel. The



Plan and Section.



Plan and Elevation of Chilling Blocks.

THE BARR CONTRACTING CHILL.

small ridges formed by the spaces between the chill blocks produce a very perceptible and unpleasant buzzing sound for some time after they are placed in service. After many endeavors to remove this objection by more perfect molding, the writer has come to the conclusion that the only practicable way of avoiding this difficulty is to trim the ridges off with a grinding machine.

Inspection and Tests.—This matter is becoming of much greater importance than formerly, and is very ably handled in the specifications and tests adopted by the Master Mechanics' Association in their convention held in the year 1888. If the requirements of these specifications are fully met, damage from breakage of wheels would be of extremely rare occurrence, and the average mileage of wheels would be much greater than at present. The writer is inclined to think, however, that for 60,000-lb. cars, the requirements as to strength should be increased. He has no data to enable him to speak with authority as to the Pennsylvania test. As to the other test of a 100-lb. drop falling 7 ft. upon the plate close to the rim, a 550-lb. wheel should require 25 blows, a 575-lb. wheel should require 30 blows and a 600-lb. wheel 40 blows to break a piece out. The writer favors the second test because it is applied in such a way that the fracture produced is a near approach to what occurs in service, and any attempt to add material to enable wheels to resist this test will result in rendering the wheel less liable to breakage in service, even if some of the metal so used be removed from the hub. On the contrary, the attempt to proportion the metal in a car wheel to resist a blow on the centre of the hub, will produce a distribution of metal which is not so well adapted to resist the breaking strains to which a wheel is subjected in service.

How Wheels Fail in Service.—The defects or the causes of wheels failing in service are comparatively few and may be classified as follows :

1. Failure of the chill. 2. Wear on the rail. 3. Cracked and broken. 4. Sliding.

1. The wheels which are condemned under the head of failure of the chill may be divided into four classes: *a*. Shelled out. *b*. Comby. *c*. Seams. *d*. Worn flat.

The defect called shelled out occurs in the tread, generally in the form of circular spots with a raised centre, varying in diameter from one-half in. to 2½ in. It manifests itself more frequently in wheels exposed to heavy and fast service, and is rarely seen in ordinary freight car wheels. It is due to a defect or lack of homogeneity in portions of the tread, and the temperature and rate of pouring have much to do with the formation of this defect, more so than any other cause, hot and fast pouring reducing this cause of loss to a minimum.

The defect designated by the word "comby" appears in the form of clusters of small rounded cavities. It is due to very cold and slow pouring, producing slag in tread, and is not found to a great extent in wheels made of good material when properly poured.

Seams make their appearance as cracks, extending around the tread of the wheel. When several of these seams occur near together, a portion of the tread drops out between them, causing a flat spot. There is every reason for believing that the development of this defect is due to the seams which may be originally seen on the treads of new wheels, and that the lack of homogeneity indicated by the seams and waves in the tread of new wheels finally develops into definite cracks extending through the white iron when exposed to service.

The defect termed "worn flat" explains itself. The name for this defect now adopted by the Master Car-Builders' Association is "worn through the chill." This term is more descriptive and much more definite. It is caused by lack of uniformity in the depth of white iron around the tread of the wheel. While no wheels have an absolutely uniform chill, at the same time the trouble from this lack of uniformity and the tendency of the wheel to wear flat is very much aggravated by slow pouring.

2. The cause of failure of wheels under the head of wear on rail are as follows: *a*. Worn tread. *b*. Tread worn hollow at flange. *c*. Tread worn hollow from flange. *d*. Worn flange. Failure in these four forms cannot be said to be due to defects in wheels, and it may be considered a useless refinement to make four divisions, but some very important information is obtained by doing so.

The term "worn tread" indicates that the wear has been uniformly distributed over the tread, not confined so as to form a groove. When one wheel on an axle is in this condition, the mate wheel is generally in the same condition. It shows the following desirable conditions:

The wheels were accurately of the same size when mounted; both wheels possessed the same wearing qualities; trucks and running gear are maintained in first-class condition; the mileage of worn tread wheels is generally considerably above the average.

When one wheel is worn hollow at flange, the mate wheel is generally found worn hollow from flange. It indicates imperfect mating, irregular wearing qualities in the wheels, or badly constructed trucks. In the writer's opinion irregular wearing qualities in the wheels mated together is the principal cause of this wear.

Worn flange in one wheel is accompanied by worn hollow from flange in the mate wheel. It indicates an aggravated condition of the causes which act to produce the two last mentioned kind of wear.

Failure from sliding is clearly a matter of manner of handling the wheel in service, and is independent of the quality of the wheel. It occurs in two forms, designated by the terms "flat sliding" and "comby sliding." The term flat sliding explains itself. The term comby sliding is used to designate a condition of the sliding spot, in which the heat from sliding cracks the white iron under the flat spot so that the metal drops out in small pieces. This defect has no relation whatever to the defect described above as comby. Close attention to adjustment of brakes and manipulation of the same, both in passenger and freight service, is the only means of reducing this source of loss. A blank for making special report of sliding wheels is appended to this report. The use of this blank, together with close attention to adjustment of brakes, has given the following results. The percentage of wheels removed on account of sliding for the past five years is as follows: 1884, 46 per cent.; 1885, 44 per cent.; 1886, 36 per cent.; 1887, 30 per cent.; 10 months 1888, 12 per cent.

Cracked and broken wheels occur in various forms, and the following terms are used in reporting them: Cracked or broken flange; cracked or broken rim; burst; cracked brackets; cracked plate; broken in pieces. These terms explain themselves and do not call for any special remark.

A wheel record should be of such a form as to allow a statement to be made therefrom, showing accurately the number, average mileage and percentage of wheels removed for each defect. This is not necessary if simply a knowledge of mileage results were required. But much more is required if the highest state of efficiency in the wheel service and the most economical results are to be obtained. In comparing the value of two makes of wheels or the same make in different years, a decrease in the proportion removed on account of the defects: "shelled out," "comby," "seams and worn flat," or an increase in the mileage, indicates an improvement in the wearing qualities of the wheels. An increase in the mileage and percentage of the wheels removed on account of worn tread indicates an improvement in quality, in running gear, and in the manner in which wheels are handled. An increase in mileage and decrease in percentage of wheels worn hollow at flange, hollow from flange and worn flange indicates improvement same as stated last above. A decrease in the percentage of cracked and broken wheels indicates improvement in the quality of the wheel, in the vigilance of inspectors, and in the care with which brakes are handled. A decrease in the number of wheels made flat by sliding indicates improvement in handling the brakes and in adjusting of the same.

The following table gives some information as to the mileage and strength of cast-iron wheels removed from baggage, express and mail cars:

MILEAGE OF WHEELS DRAWN, C., M. & ST. P.

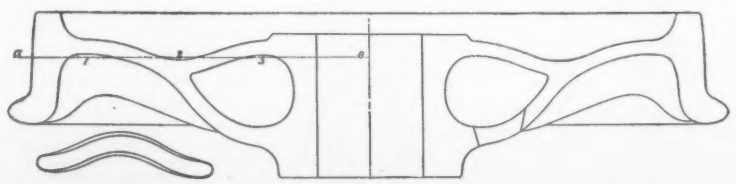
Defects.	1886.			1887.			1888.		
	No. drawn.	Average mileage.	Per cent.	No. drawn.	Average mileage.	Per cent.	No. drawn.	Average mileage.	Per cent.
Shelled out.	109	61,057	21.8	87	71,692	18.5	122	96,047	33.7
Comby	3	63,555	6.	1	68,001	0.2	3	29,455	0.8
Seams	42	61,266	8.4	67	70,267	14.2	14	99,165	3.8
Worn flat.	26	69,929	5.2	59	85,403	12.6	2	100,581	0.8
Worn tread	117	81,920	23.4	60	97,226	12.7	39	113,908	10.7
Hollow at flange	78	77,277	17.6	93	98,920	19.8	100	106,215	29.8
Hollow from flange	82	81,752	16.4	83	104,049	17.6	69	113,001	6.2
Worn flange	38	73,904	7.6	6	87,645	1.3	9	137,599	2.4
Broken flange	3	57,713	0.6	4	112,547	0.9	6	105,272	0.6
Cracked plate				10	84,114	2.0			
Cra'ked bracket	2	79,092	10.4						
Burst									
Totals	500	73,380		470	88,379		363	104,953	

Mr. Wm. Garstang, Superintendent of Motive Power, Chesapeake & Ohio, sent a paper which was read, and of which, for want of space, we can give but a brief abstract.

It is a well-known fact that a wheel that would be satisfactory in every respect, under cars of 60,000 lbs. capacity on level roads, would not give satisfaction, nor can it be used with safety on mountainous roads with long steep grades that require a very heavy application of the brakes for a long time. For example, on the Chesapeake & Ohio Railway there are grades 76 ft. per mile for 14 miles and 80 ft. per mile for 9 miles. As heavy freight trains are not allowed to make more than a mile in five miuntes on these grades, it will be readily seen that the brakes are required to be set for from one to one and one-half hours. I have seen brake shoes almost completely worn out from one trip over the road, caused by having 60,000-lb. cars on the rear of a train of lighter cars. As the tendency to crack from heat under these severe applications of the brakes is one of the worst evils, it is evident that there must be some allowance made for this contraction and expansion.

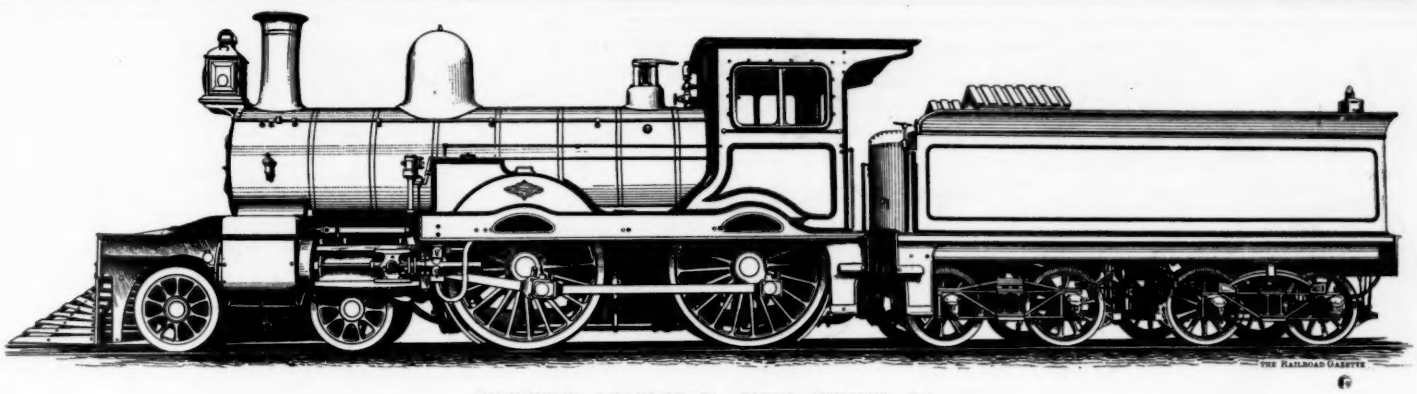
Now, if all roads kept their cars on their own roads, every manager could make a wheel of sufficient weight to suit his requirements. But such is not the case, and many roads are running as many foreign as home cars. Then should not the standard for cars of large capacity be the wheel which would meet the requirements of the roads that have the heavier grades?

I have seen many wheels broken that were made without regard to proportion, or allowance for shrinkage, and the habit seems to have grown very common for mechanical officers to receive a wheel from the maker, testing it only for its weight, without trying templates to plate or flange. The correct wheel for a 60,000-lb. car will be a wheel combining the proper design with sufficient strength to withstand the strains it will be subjected to, and the correct wheel for any other capacity of car will be the same in design, with sufficient strength for the work it has to perform. It



Plan of Rib.

CHESAPEAKE & OHIO CAST-IRON WHEEL.



PASSENGER LOCOMOTIVE, CHINA RAILWAY CO.

Built by DÜBS & CO., *Glasgow.*

follows that the design once made perfect can be increased or decreased in strength, provided the increase or decrease of weight is applied in the same proportion to every part of the wheel. For example, should it be necessary to increase a wheel 10 lbs. in weight, the plate, hub, flange and ribs should all have their proportion, and not have the 10 lbs. added in at any particular or convenient point.

In conclusion, I will refer you to this drawing, which is of a wheel weighing about 580 lbs., which is submitted as the correct design. Wheels of this design have been in service about two and a half years, and have given the best results You will see that its construction is such that the expansion and contraction is provided for in every direction, and that the plate is far enough back of the flange to get the elasticity of the flange without sacrificing any of its strength, while the ribs are extended well up on the flange and low down on the plate, making a very effectual brace. The lines *A B*, taken as a shrinkage line, allow three points for compensation—1, 2 and 3—as marked on the drawing.

A standard axle is probably of more importance than wheels, on account of the great interchange of cars, and the necessary trouble and expense to provide for numerous different kinds. The M. C. B. proposed standard, brought out in 1887, having a 4 × 8 in. journal, has not met with much favor, for the reason that it requires an entirely different construction of truck, which throws the centres of the journals further apart and increases the leverage in the centre of the axle and at the hub of the wheel, without materially increasing the journal in diameter.

As the rules for the interchange of cars condemn an axle for 60,000-lb. cars when worn below 3¾ inches diameter, it is evident that the life of such an axle under a 30-ton car will be very short, and the question that first arises is, What can we do with it? It is too long to go in any of the trucks now in use under cars of a lighter capacity, and if it were possible to change the centres of the arch bars it would not go in the oil box; consequently it is a dead loss, and has to be consigned to the scrap heap.

On the other hand, an axle made to the dimensions proposed by the M. C. B. Association, July, 1888, embodies all of the good points and meets with all of the requirements, inasmuch as the journals are 4¼ in. diameter, thereby giving a half-inch circumferential surface to be worn off, and making the necessary increase for strength, while it is lengthened enough to give a proportionately larger increase in wearing surface without increasing the centres of the arch bars or bearings, which does not increase the leverage in the centre of the axle or at the hub of the wheel. Hence, it will be readily seen that an axle of these dimensions will give longer life under the 60,000-lb. car having the additional quarter inch in the diamoter of the journals, with the advantage that when worn or turned below the 3¾ in. limit it can be readily used under cars now running of a lighter capacity, for it will work very well in the standard oil box for 7 in. journal, the only change being in the brass and wedge.

In summing the advantage, it is evident that the 4¼ × 7½ in. journal will give all the required strength for cars of 60,000 lbs. capacity, and can be used to advantage in cars of a lighter capacity when worn or turned below the limit, without any of the disadvantage that would necessarily arise from the use of an axle of larger dimensions.

I will say in conclusion that this company has several thousand of the wheels and axles herein described under construction and in successful operation.

A Chinese Locomotive.

We are indebted to a correspondent in China for a photograph of one of the passenger engines of the China Railway. This engine was built by Dübs & Co., of Glasgow, from general designs and specifications by Mr. C. W. Kinder, the Chief Engineer and General Superintendent of the line. The details were worked up by Mr. James Cleminson, of London.

It has been intended in this type of locomotive to combine American and English features, to find the merits of each and to eliminate those least useful. We understand that the company has four engines of the style shown. Two have copper fire-boxes and brass tubes, the other two have steel boxes and iron tubes. The fire door is large, as in English practice, and has a central hole with an inside air deflector. This hole is large enough to permit of coaling without opening the door, and the deflector is so attached to a quadrant that it can be set to throw the air down against the fire.

The pipes in the smoke-box are arranged so that the tubes can be easily cleaned and the petticoat pipe is completely done away with. The engines all have the English plate frame, but the cylinders are outside connected and the springs equalized. The following exact details may be noted:

Cylinders	17 in. × 24 in.
Drivers	70 in. diam.
Truck wheels	36 in. "
Boiler	50 in. "
Grate area	17 sq. ft.
Heating surface of fire-box	106.5 "
" " tubes (214)	950.5
Weight on drivers	48,000 lbs.
Tender wheels	36 in. diam.
Tank	2,200 gals. capacity

The plate frame is of 1⅛ in. steel. The wheels are cast steel, with the Stroudley & Carleton tire fastening. The tender wheels are also cast-steel centres, and 36 in. diam. The engines have steam brakes, donkey pumps and two motion pumps.

These composite engines weigh about 70 tons each with tender, and are giving great satisfaction, but as the water is very bad they can seldom run over 300 miles without washing out. They have been in use for a short time only, and have scarcely had a chance to show the advantages or disadvantages of the American features in the designs; but it is reported that the steel fire-boxes are more leaky about the door and tubes than those of copper. This, our correspondent remarks, is probably due to the fact that the English makers are unused to handling steel for that purpose. A light American Grant locomotive, on the same line, has been in service for a much longer time, and does not give any trouble in these particular places. Janney couplers are used on tenders, as well as cars, with good results, and as soon as the traffic warrants it Westinghouse automatic brakes will be applied to all cars.

Our correspondent says: "I consider these engines real beauties and well worthy of being the first full sized engines sent to China." He does not give the price of them, but we are informed that they cost in England little more than half what the New South Wales government is paying for their locomotives built in Australia. The freight from England was about £200 each, including all charges.

Our correspondent thinks that no further experiments are likely to be made with frames, as no doubt is felt that plate frames are best, and he adds: "I fancy that in the United States you will adopt them if any big-bug once has the pluck to start it on a decent line. Now that you can roll plate of any size cheaply it seems to me that the chief reason for adopting the old bar frame is gone for ever. If properly designed the plate frame is not in the way when examining eccentrics, etc., from the outside, and the running board can be raised as high as your practice prefers, giving plenty of room for splashers, etc., of your usual type."

On this road some cars are running with English wheels in one truck and Lobdell's in the other, for the purpose of testing the two.

Locomotive Tires.

We gave last week the remarks of Mr. G. W. Rhodes before the Western Railway Club on the subject of the relative wear of thick and thin tires on locomotive drivers. In the discussion which followed Mr. Rhodes said: While the statement given shows everything lumped together, without taking into account the different conditions of service, it does put the same sized engines together. But here is a case which has no connection with the previous statement. It is a letter from one of the master mechanics of the C., B & Q.: "We inclose you herewith a statement of the comparative performance of locomotive tires 3 in. and 4 in. thick. On March 8, 1887, we ordered one set each of 3-in. tires, 44-in., 53-in. and 57-in. inside diameters, in accordance with your letter of Feb. 23, 1887. The 44-in. tires were put in service under engine 448, Oct. 21, 1887; the 53-in. tires under engine 95, Dec. 31, 1887, and the 57-in. tires under engine 74, Aug. 31, 1887. As they have been in service so short a time, the results are necessarily incomplete. We selected three engines with the same respective weight on drivers, and in the same class of service, also having 4 in. original thickness of tires under them, of same makes as the 3 in., to make a comparison with. We find the 44 in. tires have been turned once, but the 53 in. and 57 in. 3-in. tires are still in service, not having been turned yet; the measurements of the same being taken on the 13th inst. In each of the three comparisons the 3-in. tire shows the greater average mileage. We call your especial attention to the results of the first turnings on the two sets of 44-in. tires, the 3-in. tires having made more than double the average mileage of the 4-in. tires, and that under an engine 4,400 lbs. heavier. The 53-in. 3-in. tires were also at a disadvantage, as compared with the 4-in. tire, the latter making one-third of their total mileage without driver brake shoe wear, while the former had driver brake shoe wear during the whole of their mileage." This is a statement from one of our master mechanics, which has no connection with the previous statement, that being from the regular records of the office.

Mr. CUSHING: My own experience in the use of very heavy and medium weight of tires sustains the finding of the C., B. & Q. In talking with master mechanics around the country I find a pretty general sentiment in favor of a medium weight and thickness of tire, rather than the very heavy.

The CHAIRMAN: It is pretty generally conceded that the difference in the service of a thick and thin tire is attributable to the texture of the metal. I have heard that talked for quite a long time.

Mr. MUNTON (Chicago Tire & Spring Co.): I quite think the difference in the results obtained is in the working of the steel. Aside from the working I think you will perceive that there is some argument in favor of the thin tire, on account of the contraction. If a tire is properly heated and made soft right through, it is the practice to roll it out as quickly as possible, and clean and cool it with water; therefore the outside is cooled off rapidly, and the inside is left at about the same heat that it was when first put on. On account of the severe pressure put on it will hold its heat. Therefore the inside of that tire will be inclined to shrink away from the outside. In the case of a 3-in., or even 3½-in. tire, I think the work is pretty well sent through: but when you come to 4 in. there is a difference. We have successfully made some 5-in. tires that have given very great satisfaction.

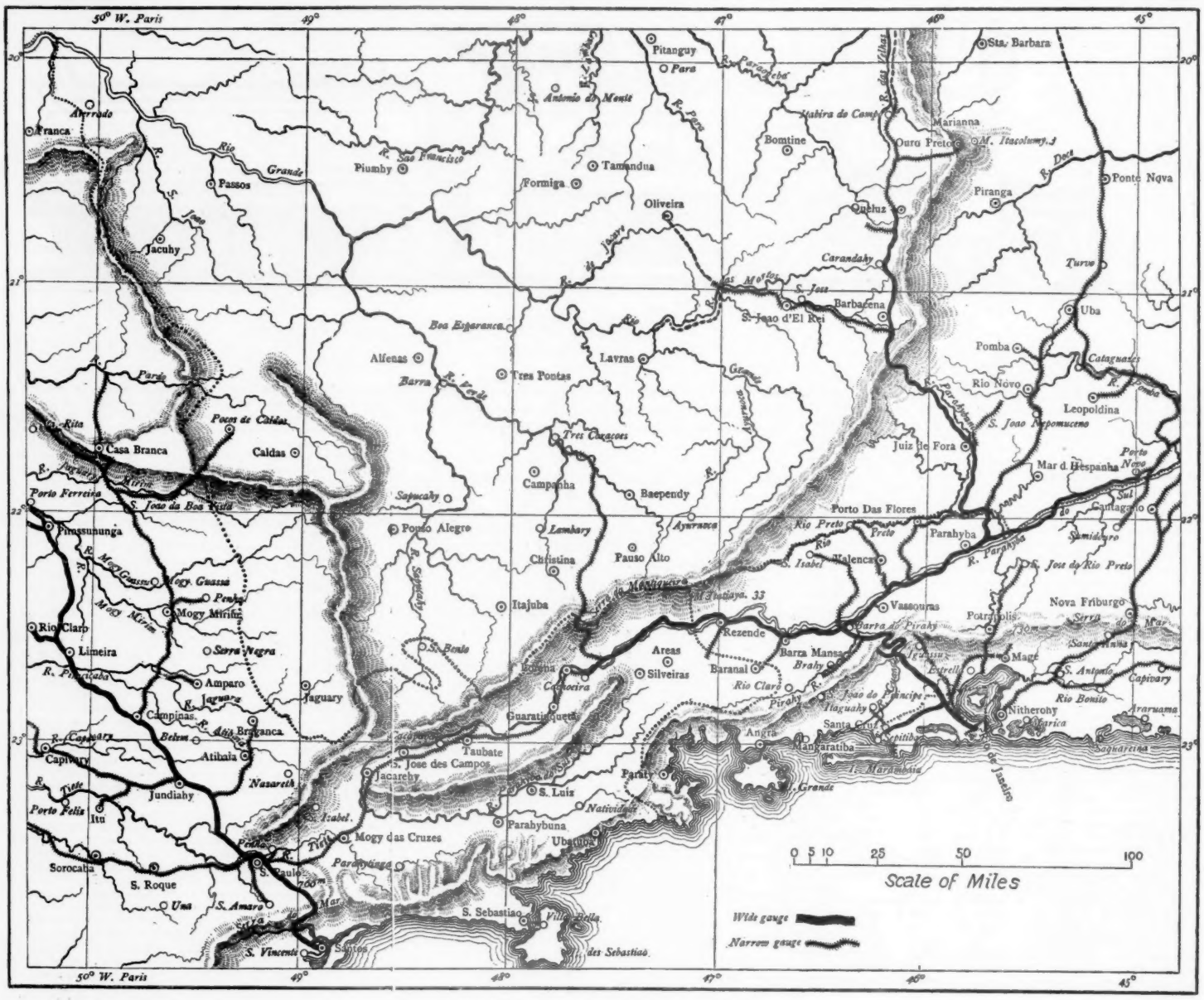
Mr. FOWLER (Fowler Cast Steel Wheel Co.): The Fowler cast steel wheel is something at present very new. We have not had it in service long enough to establish a record. It is cast from open-hearth steel, a blank much larger in diameter than the finished wheel from which it is rolled. When the wheel is brought to a cherry red heat we place it upright in the machine, which exerts a pressure upon the tread and flange of the wheel of about 2,500 tons. The pressure is brought upon the tread and flange of the wheel by five rolls, which space the wheel in opposite directions. They are fed upon it in the same principle as a universal chuck, all coming to a common centre. The engine which controls separately the rolls is 180 to 1 in its revolutions, meaning 180 revolutions of the fly-wheel to one revolution of the screw. In that way we get our enormous pressure upon the tread and flange of the wheel. When the rolls first strike the wheel they are revolving, and their contact with the surface of the wheel necessarily forces the wheel in an opposite direction. That pressure continues until the required diameter, whatever the machine is set at, is reached. By that enormous pressure of 2,500 tons we reduce the diameter of the blank from which the perfect finished wheel is produced. The pressure condenses the metal. The effect of the reduction of diameter is visible about ⅝ of an inch from the surface of the tread inwardly. It also affects the entire flange. We claim for the solid steel wheel that it is lighter by 150 lbs. than any steel tired wheel of the same size. It is a denser wheel in its metal. It is not hard, and our experience has taught us that the hardness does not add to the wear of a wheel. The metal in it is undoubtedly denser than in a 4-in. tire. The pressure of the rolls brought to bear upon the wheel, being such as to reduce it in diameter, and at the same time make an absolutely round wheel, it also has a tendency to make a perfectly balanced wheel, and we fully believe that by the pressure which our rolls bring to bear upon the tread and flange of the wheel while it is hot, the metal is condensed to such an extent that it will outwear any steel-tired wheel.

Mr. SWANSON: I have had no experience whatever with the 4-in. tires; our tires are altogether 3 in. When this question was up before the Master Mechanics' Convention last year, I answered some questions; but as I had had no experience with the 4 in. tire I simply cited an instance that I saw of two engines, exactly the same weight, with 3 in. tire, 44 wheel centre and another one. One of them had made more than double the mileage that the other had in the same service. Had there been a difference in the thickness of those tires neither one should have had any credit for it. I cannot say that it was the fault of the material; that is, I am not positive it was, but such was the result. The question of tire wear came up the other day in our shop, and I looked up a set that had been running 26⅛ months, and I found they were made by the same maker who had made the bad set before. I found that they had then made 141,000 miles, and were in good shape. So that there is a very marked difference in the quality of 3 in. tires, and the results that you get from them, and so there may be in the 4 in., and in coming to a conclusion in this matter, it is quite possible that you give credit where it doesn't belong.

Regarding the adoption of a standard, I will say that as far as the gauge is concerned that is our standard right through. We commence at 38 in., and vary 6 in. up. Regarding the width of a wheel, there is no doubt in my mind that 5¼ in. would answer all purposes, although we always order 5⅜. But we always do our own boring and face the outside, and it leaves the tire actually about 5⅝. Our wheel centres are 5¼ wide, and I don't know that I want to go any lower than that. I think it is an important matter to have your wheel centres as wide as possible, as a narrow wheel centre, I think, is more liable to get loose. I like 5¼ wheel centre, and a little over that in width for the tire, so that they project a little bit.

Mr. JOHANN: I am quite sure a standard is economy. At the same time it gives the tire makers the advantage of perfecting their rolls in such a way that they can keep rolls on hand by which they may know that they will get rid of tire after they roll it; and, as Mr. Rhodes has said, the matter of carrying stock is quite an important item. So far as my observations go in the matter of steel tires I doubt whether there is really much difference in the density of the metal in a 3 or 4 in. tire. My rule has been 3½ in., and I thought that was quite heavy enough and never went beyond that. I never have given it much attention to see whether there was any difference between 3 and 3½. The reason we went to 3½ was that we thought we could get a little more wear, and we wanted to save the labor of renewing the tire. So far as the wear of the tire is concerned, there is one point that I would remark upon here that none of the members have brought in, and that is the men handling the engines. It is my observation that the wear of tire does not depend altogether upon the quality of material in the tire; it depends very much on the way the engine is handled.

So far as the width of tire is concerned, being one of the committee that was engaged in adopting those standards, I will say that that matter was purposely left open, just as Mr. Rhodes states, because there was a large portion that



RAILROAD MAP OF PART OF BRAZIL.

wanted this and wanted that, and we wanted to conciliate and harmonize. I have always used 5½, and it answers the purpose. In one little experience I perfectly tested the difference between open hearth tire and crucible steel tire. The experiment was as fairly tried as it possibly could be, and to my utter astonishment the open-hearth tire showed, if anything, a little the best result at the end.

The Railroads of Brazil.

The first railroad in Brazil was opened in 1854 and since then the railroad system has been gradually extended, the average mileage in operation in 1887 being 5,124 miles, 503 miles having been completed during that year. The greater portion of the railroads of Brazil have been built within the last ten years. The earlier and more important lines were on the 5 ft. 3 in., or Irish gauge, but the branches and extensions into the interior have been made on various gauges, that of one metre being the most general, though many lines have been constructed on gauges both slightly wider and narrower, including 43.3 in., 41.3 in., 37.4 in., 29.9 in., 29.5 in. and 26 in. This peculiar variety of gauges is probably due to the great extent of the country and the fact that most of the lines are isolated, running from a port on the seacoast into the interior and not connected with any other line. The population being sparse, the traffic is light, while the numerous mountains of the coast range necessitate steep grades and sharp curves. A cheap style of construction is therefore advisable, and consequently 83 per cent. of the open lines and all the lines now under construction are narrow gauge. While this proportion is larger than obtains elsewhere, it appears likely to increase, owing to the peculiar circumstances found in Brazil.

The following statistics as regards the comparative cost and traffic of the broad and principal narrow gauge lines are based on the Annual Report of the Minister of Public Works. The information available is not, however, complete for all lines, especially as regards the earnings and car and locomotive mileage, which have consequently been omitted. The statistics as to the steepest grades on the various lines refer only to those worked with ordinary locomotives, as considerably steeper grades are worked by other methods. On one broad gauge line, the San Paulo, four inclined planes are worked with wire ropes and stationary engines, the inclination being 544 ft. per mile. The Fell system is used on a grade of 1 in 12 (440 ft. per mile) near Rio Janeiro, and the Riggenbach system of a rack rail is used on a grade of 792 ft. per mile.*

The weight of rail in most general use on the narrow gauge is 40 lbs. per yard. The maximum and minimum weight of rails used on the broad and narrow gauge lines respectively are given in the table:

It will be seen from the table that the broad gauge lines haul the principal part of the traffic and that they carry three times the number of passengers, 50 per cent. more cattle and have nearly double the freight tonnage of the narrow gauge lines, though the latter have nearly three times as much mileage and more rolling stock. Many of the narrow gauge lines have, however, been but recently opened and many are still incomplete, and it is possible that they will make a better showing when the traffic is more fully developed. The traffic certainly would seem capable of considerable extension, especially as regards freight. The latter consists principally of coffee going down to the coast, and the return freight is chiefly manufactured and imported goods sent into the interior. The freight, therefore, will bear high rates, which possibly largely accounts for the small tonnage. The revenue from the government lines shows a very satisfactory increase, but the figures are too incomplete to admit of any general deductions being drawn.

*A locomotive for working this line is illustrated in *Recent Locomotives* (enlarged edition).

PRINCIPAL BROAD AND NARROW GAUGE RAILROADS OF BRAZIL.

Railroads.	Roadbed.					Traffic.			Rolling Stock.		
	Total length. Miles.	Cost per mile. Dollars.	Sharpest curve. Deg.	Steepest grade. Ft. per mile.	Weight of rails. Lbs. per yard.	No. passengers. Thousands.	No. cattle. Thousands.	Tons freight Thousands.	Locomotives.	Passenger cars.	Fr'ght cars.
Five broad gauge	888	49,500	4° 22′ to 9° 39′	66 to 105	65 to 80	4,381	129	1,156	195	377	3,333
Twenty-one narrow gauge	3,023	22,500	11° 25′ to 22° 13′	95 to 176	38 to 50	1,405	82	656	249	409	3,106

The accompanying map of Brazil shows but a small portion of that empire; but the district embracing Rio Janeiro and San Paulo contains the greater portion of the railroads in operation and under survey.

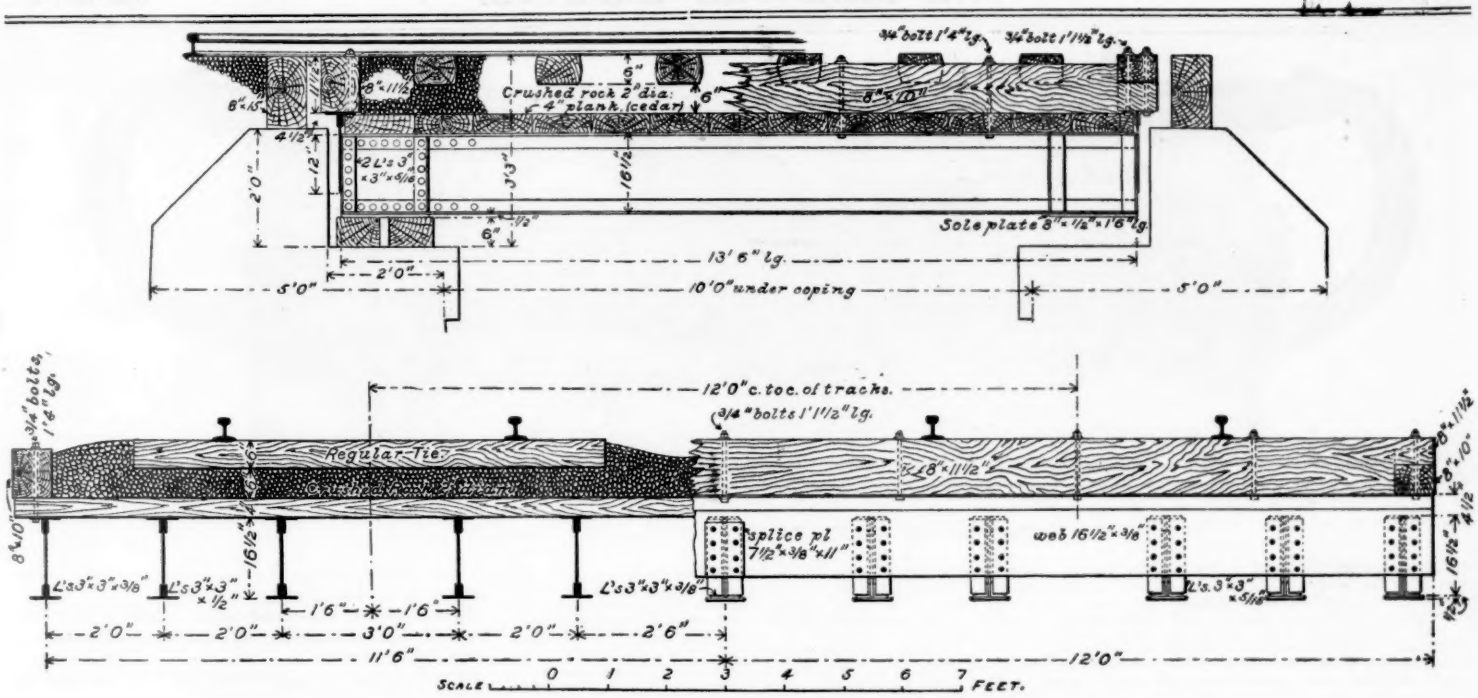
The majority of the locomotives employed on Brazilian railroads are of American or English build. Some French and a few Belgian engines are also in use. On many lines

None of the railroads are large, and the average length of each line is under 100 miles. The largest and most profitable systems are the Dom Pedro II., a broad gauge, government line running inland from Rio Janeiro; the San Paulo, an English broad gauge company running from the port of Santos to San Paulo, and the Leopoldina, a metre gauge line, owned by a Brazilian company and situated in the provinces of Rio Janeiro and Minas. Few of the short narrow gauge lines yield as yet satisfactory returns. More than half of the lines are owned by Brazilian companies, but the more important lines have been built either by the government or by English companies. One line was built by a French company and runs from Paranagua to Aurytiba, in the Province of Parana. This line crosses the Sierra de Cubatao 3,000 feet above the level of the sea.

The early lines were guaranteed a minimum dividend of 7 per cent. by the government, which agreed to make up any deficiency should the net revenue prove insufficient. This method has in many cases been departed from, and many recent lines are either built and worked by the government or are built by independent companies without any guarantee.

During 1887 the mileage opened for traffic was as follows:

	Miles.
Companies guaranteed by National Government	161
" " " provincial governments	34
" with no guarantee	197
State lines	111
Total	503



CULVERT MADE OF OLD FLOOR BEAMS.

NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

American locomotives are exclusively used. The majority of the locomotives on the Dom Pedro III. and Leopoldina lines are also of American build. The passenger cars are chiefly built in Brazil, though numerous American and English cars are used. The returns indicate that the freight cars are usually of Brazilian or English build, though over

Culvert Made of Old Floor Beams.

We show herewith in elevations and section a culvert made from old floor beams, as built on the line of the New York Central & Hudson River. As shown here the floor is planked, and covered with stone ballast. This construction is used where the existing masonry is good but not heavy enough to be considered permanent. When new masonry is put in, the decking will be of steel throughout.

The old floor beams are sawed off square and of equal length in a cold-saw mill. New sole plates are riveted on as shown in the elevations. The ends are also made of old beams, with lower flanges removed. The plank decking is expected to last 15 years if cedar, 12 years if yellow pine, and 30 years if of cypress.

The cost of labor on the old beams is but small, and an excellent and cheap bridge is made. The use of stone ballast gives a continuous, uniform track, easily kept in surface. The details of construction are so clearly shown as to call for no further description.

Water Circulation and Purification—Western Railway Club.

The regular monthly meeting of the Western Railway Club was held Dec. 18, the attendance being larger by far than any previous meeting.

Mr. Herbert Hackney, Assistant Superintendent Machinery, A., T. & S. F., read a paper on "Water Circulation and Purification of Water," which we give below, somewhat abridged.

It is a well known fact that in order to absorb the greatest amount of heat from a given heated surface it is necessary to get as many particles of the water or gases to come into contact with this heated surface as possible. Starting with a boiler full of cold water, the water lying next above the mud ring being practically removed from the effect of the fire, inasmuch as it lies below and out of contact with the zone of combustion, practically remains stagnant, for the reason that you cannot induce hot water to descend into or beneath cold water without some other agency than gravity. Immediately after starting a fire in a locomotive fire box all of the water lying above the zone of combustion must, of necessity, be warmer than that lying below; consequently, it cannot replace the water lying next to and just and above the mud ring.

My experience has been that fire-boxes on locomotive engines where bad water is used usually require patching first at a point from 12 in. to 18 in. above the mud ring, varying with the height of the grate above or below the mud ring. On all locomotives, and at all times when in service, the fire in the fire-box heats the sheets, which in turn heat the layer of water next to them, making it lighter than the neighboring water by expanding it, thus causing it to rise, and we have a thin sheet of water ascending next to the fire-box sheets on all sides of the fire-box. At the same time, we have an immense surface exposed to the action of the weather, which conducts away the heat contained in the water next to the outside sheets, causing the water to contract into volume, thus becoming heavier, and we have a descending sheet of water next to the outside shell of the fire-box. The water so descending being, however, warmer, than the water below the zone of combustion, cannot descend into this water, hence stops its downward course at a point just opposite to or just below the zone of combustion, where it passes over, and coming into contact with the heated sheet of the fire-box, ascends in turn. By this change of direction from a downward to an upward course, my opinion is that the particles of solid floating matter contained in the boiler water are thrown against and baked upon the fire-box sheet, thus preventing the water from coming into contact with the sheet and absorbing its heat, thus allowing it to become overheated, and resulting in bulged and cracked side sheets of fire-boxes.

Immediately around the fire-box is undoubtedly the hottest portion of the boiler, and water exposed to the fire-box sheets unboubtedly attains a greater heat than the water next to the front or smoke-box flue sheet. On this account the heated water from the fire-box, being lighter, tends naturally to occupy the higher portions of the water space in the boiler, crowding the less heated particles of water to lower altitudes. I think if we could see the inside of a boiler when in service, we should observe that to a certain extent there is a continual flow of water from the fire-box to the front end of the locomotive, following the outer shell of the boiler downward to the bottom below the flues, and along the bottom of the shell to the water leg. This is modified to a degree for the reason that a large portion of the steam generated in the boiler is, no doubt, generated at the fire-box end. The water used in making this steam being taken out of the boiler water at that end, tends to a certain degree to overcome this natural tendency of the water to move forward. Then, too, the feed water being about 150 deg. F., whereas the water in the boiler in ordinary service is about 325 deg. to 350 deg., naturally causes the water entering the boiler to sink to the bottom of the shell and thence along its lower portion to the water leg, where it either becomes heated and ascends in the natural flow of water, or sinks to the bottom, displacing and causing some of the botter water to move upward.

On account of the very large portion of the water being evaporated at the fire-box end of the boiler, the impurities which the water contains are precipitated upon the crown sheet of the fire-box, because there is no inducement for these particles to move away to some other part of the boiler. The side sheets of the fire-box, on account of the flow of water upwards along their surfaces, accumulate more or less solid matter in the form of scale, thus wasting a large proportion of fuel and giving endless trouble and expense on account of repairs.

Some years ago I observed that the water in a boiler when in service, more especially heavily charged with mineral, such as carbonate and sulphate of lime and magnesia, carried a floating floculent precipitate. It occurred to me that if this water could be passed through a filter or settling chamber while being circulated the two results might be obtained of causing circulation, and while in the act of circulating separate the impurities from the water. Upon investigation, I ascertained that in order to precipitate the carbonate of lime and magnesia it was necessary to heat the water to a sufficient temperature to expel the carbonic acid, thus breaking the bond between the lime and the water, as carbonate of lime and magnesia are soluble in a water which contains carbonic acid. It is impossible to separate these scale-producing elements from the water without having the two agents, heat and ebullition. If I understand the matter correctly, water contained in an absolutely closed vessel could not possibly expel the carbonic acid gas, and hence could not let the lime and magnesia be precipitated. To this fact, I think, is due the failure of the many so-called feed-water purifiers.

In the course of my experiments, with reference to the circulation of boiler water, I finally concluded that the device which was patented by me Aug. 7, 1888, meets the requirements more completely than any arrangement I have ever tried before or since. The fundamental principal of the invention is its circulating feature. Taking the water from the coldest and most stagnant part of the boiler, forcing it by expansion to rise to the hottest part, it most assuredly produces the much desired effect of thorough circulation. The second important characteristic of the device is its capability of taking the coldest water from the boiler, also the water which carries the most precipitate, through pipes passing through the fire-box and into a large settling chamber in the upper part of the boiler. The pipes passing through the fire-box being 2 in. in diameter, and the settling chambers in the interior of the boiler being 6 in., the circulation of the water in the fire-box pipes, which would be rapid enough to carry the particles of mud and lime through them without burning, would be sufficiently slow in passing through the 6-in. settling chambers to enable the sediment to fall to the bottom. On account of the inverted angle-iron at the bottom of the chambers the impurities naturally fall into the valleys on each side of the angle-iron, the edges of which are notched, and the surface cock being connected to the space underneath the angle-iron, it is quite clear that by opening the surface cock all the mud and impurities lying in the valleys on each side would be forced through the notches in its edges and expelled from the boiler with the least possible amount of hot water being blown out, and yet thoroughly cleanse the settling chambers. This idea was for the purpose of economizing, as much as possible, the hot water in the boiler. On account of the circulating pipes in the fire-box taking the coldest water, there is no danger of the water being filled with steam bubbles, as would be the case were the pipes to take the water from above the zone of combustion, hence there is little danger of the pipes being burned out.

On the 15th of March, 1888, we put an engine in service with two of the circulating pipes and two of the settling chambers and she is still in service, giving us no trouble whatever and running on water averaging 25 gr. of scale-producing matter to the gallon. This, I think, clearly demonstrates that the pipes are not liable to give more than the ordinary amount of trouble.

The fire-brick arch supported on pipes has been considered objectionable by some master mechanics on account of the pipes crossing the path of the flame and cinders, thus giving trouble on account of abrasion, the sharp particles of coal and cinders being lifted by the exhaust and thrown against the pipes, in some instances wearing the pipes away until they become too weak for use. To avoid this objection the pipes in my invention have been so arranged as to follow as nearly as possible the path of the sparks. If the pipes ever wear out it will be necessary for them to wear out their entire length, as there is no particular part exposed to cross fire from the cinders. The arched shape of the circulating pipes enables them to expand and contract freely when subjected to different temperatures. The exposed position of the pipes to the heat of the fire on all sides insures the water in the pipes becoming heated very soon after a fire is placed in the fire-box, even if the boiler water be cold. This, of course, materially accelerates the circulation of the water in the boiler from the start.

Two engines of the same make were turned out of the round house at the same time ready for train, one with circulator and one without, everything as nearly alike as could be. I could hold the points of my fingers against the sheet, above the mud-ring of the one having no circulator for an indefinite time, though there was a 120 lbs. of steam on the boiler. Placing my fingers against the side plates, just above the mud-ring of the engine having the circulator on I found it expedient to remove them after allowing them to remain on the sheet as short a time as I possibly could. The difference in temperature on the two sheets must have been 150 deg. By experiments with a thermometer I found that the temperature of the water 3 deg. above the mud-ring varied about 5 deg. to 10 deg. from the temperature of the water in the highest part of the boiler, whereas without the circulator the temperature would vary from 60 deg. to 120 deg., being very much colder just above the mud-ring than the water was at the upper part of the boiler.

The following are the numbers of engines which we have equipped with this device and their performance, viz.:

Engine	Put in service.	Times washed out to date.	Average mileage between washouts.	Scale matter in water, grains per gal.
No. 1	May 26	5	4,500	25
2	Aug. 18	3	4,500	25
*B51	April 5	7	3,750	30
B55	April 28	6	4,000	30
105	Aug. 1	4	4,600	30
507	May 19	4	4,500	
508	May 31	5	6,000	
43	April 28	4	4,500	
545	Oct 15	1	6,685	
‡231	June 4	1	6,854	

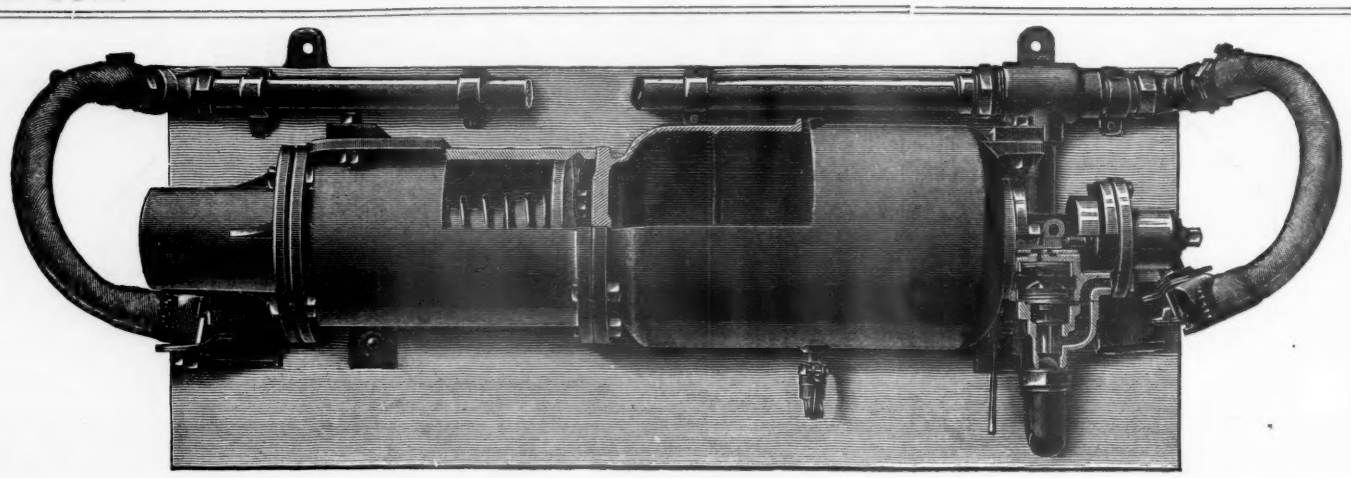
That the settling chambers do accumulate sediment can be very readily shown by allowing the engine to run 20 or 30 miles without opening the surface cock and then opening it gradually, when, on water like the Santa Fe uses between Topeka and Kansas City, a pail full of thick creamy colored water will flow from the blow of the pipes. The most remarkable feature of this device, however, in its workings, is the condition in which the fire-box sheets are found to be

* Equipped with circulator of half capacity.

† In switching service, on very bad water, has been in service at Osage City, 34 miles west of Topeka, since Oct. 7, and has not been washed out since that date; she is running on coal mine water and has given us no trouble of any kind.

‡ She afterwards went into service Aug. 30 and was washed out Oct. 30, making 5,300 miles; this on Cottonwood division water on which the life of a set of flues will not average over four months.

Engine 275, without circulator, went in service June 2 and was washed out every 450 miles, and on Sept. 28 had to be taken in for a new set of flues, making 13,000 miles, washed out every 450 miles. This shows conclusively that the circulator prolonged the life of the flues of engine 231 39 and a fraction per cent. The consumption of coal showed in favor of engine 231 to the amount of 11 8-10 per cent. Engine 506 went in service June 6, between Dodge City and Coolidge, where the life of a set of flues will not average over six months, and has averaged over 4,000 miles between washouts. Engine 68 went into service June 16, after having run on all kinds of water, over the entire system, went to San Marcial without being washed out; total mileage made before being washed out 3,100 miles; then found to be almost entirely free from mud and scale. Since that time she has been running on the Rio Grande division, water which is considered bad, and averaging over 6,000 miles between washouts. Engine 41 went into service Nov. 11, and is still running without having been washed out.



INSTRUCTION MODEL OF THE WESTINGHOUSE BRAKE.

after an engine has run 5,000 miles without having steam taken off or the water changed. An engine having made this mileage was held in for a washout, the water allowed to flow gently out through the blow-off cock, and on taking the washout plugs out of the wagon tops I discovered on the crown sheets what looked like a crumpled brown paper, wet; nothing seemed to be adhering to the crown sheet, but there seemed to be a loose buckled layer of scale. Upon introducing the hose into washout holes this was easily washed off, and upon examination the crown sheet, which, when leaving the shop had a scale of from $\frac{1}{32}$ in. to $\frac{1}{8}$ in. thick, was found to be, after making 5,000 miles, without being washed out, absolutely free from scale, and no scale has since accumulated on the crown sheet, although this engine has run since April 28 on water averaging 25 gr. of scale-producing matter to the gallon, and the engine averaging over 41,000 miles between washouts, Nothing was done to purify or change the feed water before entering the boiler.

The Union Pacific have put one circulator of half capacity in an engine which has made 2,800 miles without being washed out, and was found to be so clean that the master mechanic informs me he sent her out of the shop with the understanding that she must make 5,000 miles before coming in again. This on the division between Wamego and Missouri river points. The water which is considered the worst on the Union Pacific is on the sixth division between Ellis and Denver. Engine 712, equipped with a circulator, was sent there and ran 2,800 miles without being washed out, which they consider something extrordinary, and wrote me to that effect.

President Rhodes asked what is meant by a "circulator of half capacity."

Mr. Hackney: We have decided that a four-pipe machine is about right. We have had our best results from a circulator composed of four pipes in the fire-box. But when we put in only two pipes we call it "half capacity." The reason the Union Pacific do that is that they had the flues in the engines and couldn't put in more without crowding. We have decided on a 16-in. cylinder engine or less to use two pipes, and so we call a two-pipe device a half capacity.

The President: Where you speak of using waters of twenty-five grains or thirty grains of scale-producing material, do you mean the solid contained in the water?

Mr. Hackney: I mean what would form a hard scale—not sand and such things. It means only what would adhere to the sides on the evaporation of the water, not the sediment.

President Rhodes: I feel very much interested in what Mr. Hackney has said. On our road, on some of the Western divisions, we have to wash out our boilers, and I have several times had to settle disputes between superintendents as to whether boilers should be washed out every trip, or every second trip. In the East that question does not come up so much. I met Mr. Lauder yesterday, and we were talking on the subject of washing boilers out. I was quite surprised to hear him say that the boilers on his road were washed out only about seven or eight months, and that their flues lasted from eight to nine years. I feel like trying one of Mr. Hackney's devices right away.

Mr. Hackney: The round trip between Atchison, Topeka & Kansas City is 144 miles. Prior to trying this device we have on some occasions run the engine three of those round trips—three times, 144 miles. But that would be exceptional, and the rule has been to run twice the round trip, or 288 miles. Those engines now run 40 to 50 days, making 144 miles per day. They run from 5,500 to 6,000 miles right along.

Mr. Cushing: Have you observed any economy of fuel?

Mr. Hackney: If you were to start two engines out new you wouldn't notice, perhaps, any perceptible difference, on account of both engines being clean. I figured up a comparison between two engines, and the result showed 11½ per cent. in favor of the circulator. Then, too, engineers, when they first handle the arrangement, are liable to over-blow—blow too long; and I didn't interfere with them because I didn't want the engineers feel that it was a matter that was going to call for much of their attention. The men who formerly blew the device a minute and a half or two minutes, and every half hour or so, now blow it about thirty seconds every hour and a half, and they get better results, and say so. I have allowed the engineers to instruct themselves with the arrangement, because I preferred they should do so. For the past six months we have been working on ever so many new varieties of coal, but we have not got down to any standard yet, and there is no telling that an engine will get the same kind of coal two consecutive days; but taking the number of engines, it shows between 5 and 10 per cent. of economy of fuel.

The President: You spoke about one engine using coal mine water. Do I understand that that is the water pumped out of the coal mine?

Mr. Hackney: No; they pump the water out of the coal mine, and it runs into their supply stream. There is some iron in it and sulphur. It is bad water for boilers. It produces a very heavy scale, and the engines that run there come into the shops for more repairs than ordinarily.

President Rhodes: What Mr. Hackney says about this coal mine water struck me particularly. Last fall we had on our road a great deal of trouble from leaky flues on one of the divisions of the road, and it seemed to be unaccountable why our flues leaked so on one particular division. We investigated the matter as carefully as we could, and we thought there was some carelessness in the shop, that possibly our men were neglecting the flue work; but at last one of our master mechanics, in looking over the water on the division, found that a new coal mine had been opened and that the water from this coal mine was being pumped and was flowing into the stream which supplied one of our water stations. The water was of a reddish color, and seemed to be very full of iron and sulphur. We stopped taking the water for about a week, and immediately the complaint from leaky flues stopped. I am surprised to hear Mr. Hackney say that with this circulator he has an engine that can use coal mine water for a couple of months without injury to the tubes and boiler. It does look as though the device was well worth attention.

Model of the Westinghouse Brake.

The illustration of the Westinghouse brake apparatus, mounted as a model for purposes of instruction, which we present herewith, is taken from *Industries* (London). Concerning it that journal says: "The Westinghouse Co., with a view to encourage the study of their system of brake apparatus, have conceived the idea of supplying technical colleges and museums with a full size set of working gear, such as would be required for one vehicle, with the exception of the brake blocks, rods and levers. The apparatus, in fact, forms a full size model of the latest form of quick-acting brake, conveniently mounted on a board, which can be fixed to the wall of the lecture room or museum. The chamber containing the triple valve and portions of the auxiliary reservoir and brake cylinder are shown in section, so that the working parts can be fully examined and explained to students, who will thus be enabled to easily grasp what are usually considered the complicated parts of the Westinghouse brake. The above illustration represents this model, and we may mention that two sets have already been ordered by the Department of Science and Art, one for the South Kensington Museum, London, and the other for the Edinburgh Museum."

Spiral Molding Attachment.

The cut herewith represents a new spiral molding attachment applied to a 6-in. single head sticker. It can also be run in connection with a friezer, with a chuck spindle, universal woodworker, or any machine on which the bed or mandrel is adjustable.

The attachment will cut spiral molding, both single or double twist, and any number of strands on rope molding at one operation. It will cut from $\frac{3}{16}$ in. to 4 in. diameter, and any length. It is a very simple and reliable tool, and will do a large quantity of work. It is not liable to disarrangement, and a boy can run it. All that is necessary is to put the stick in the machine and attach the crank-handle to stick and turn it, no pushing being required.

The number of patterns that can be cut is practically unlimited, as any desired pattern may be cut with bits of a suitable shape.

Further information may be obtained from the builders, the Egan Company, of Cincinnati, O.

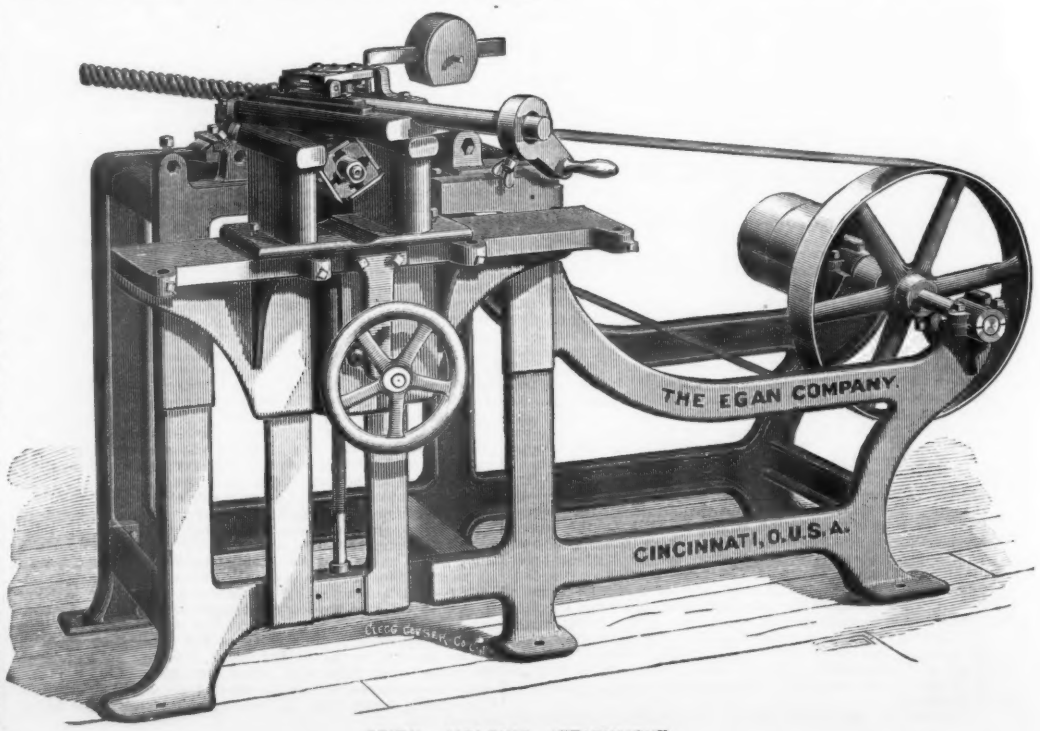
On Variable Load, Internal Friction, and Engine Speed and Work.*

This paper describes and discusses some experiments made by Messrs. Carpenter, Berger, Preston, Day, Riley, Gillis and Buchanan, on engine friction, and is supplementary to a previous paper by Prof. Thurston on the same subject. The general result of the experiments indicates that with such engines as were tested, the friction is practically constant when the speed is unchanged, whatever be the load; that the friction generally increases slightly with increase of speed; increases somewhat with increase of steam pressure, and is materially affected by the kind of lubricant employed and the mode of lubrication. The diagrams herewith presented illustrate graphically most of the experiments, and need but little explanation. Fig. 1 shows the effect of changing the steam pressure, and Fig. 2 gives the experiments at different speeds.

The Jarvis engine, with which unusually high speeds were obtained, is a new type, without connecting rod, the piston-rod being attached directly to the crank-pin, and vibrating in a movable cylinder-head instead of a trunk. It will be seen that in one case the friction decreases with increase of speed, and the writer remarks:

"The curve for the 8 × 12 automatic engine is anomalous, and differs from every other curve obtained, in falling with rising speed. It is evident that this engine differs, in some respect, from all ordinary engines in its law of variation of internal friction with engine speed. The smoothness of the curve would indicate that this is a real attribute of this engine, and not a mere accident of the time or of the construction of the machine." Fig. 3 shows the effect upon the friction of changing the point of cut-off, and indicates that the friction increases slightly as the ratio of expansion is diminished. "The same engine, tested by the two pairs of observers, in 1887 and 1888, shows different absolute mag-

*An abstract of two papers by Prof. R. H. Thurston read at the Scranton meeting of the American Society of Mechanical Engineers.



SPIRAL MOLDING ATTACHMENT.

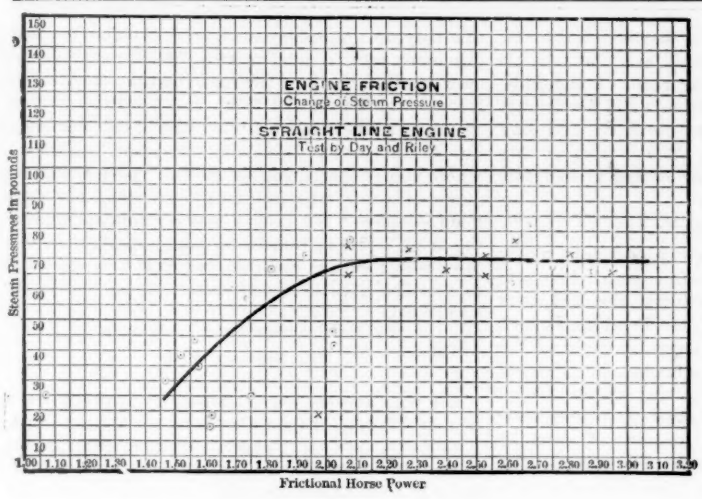


Fig. 1

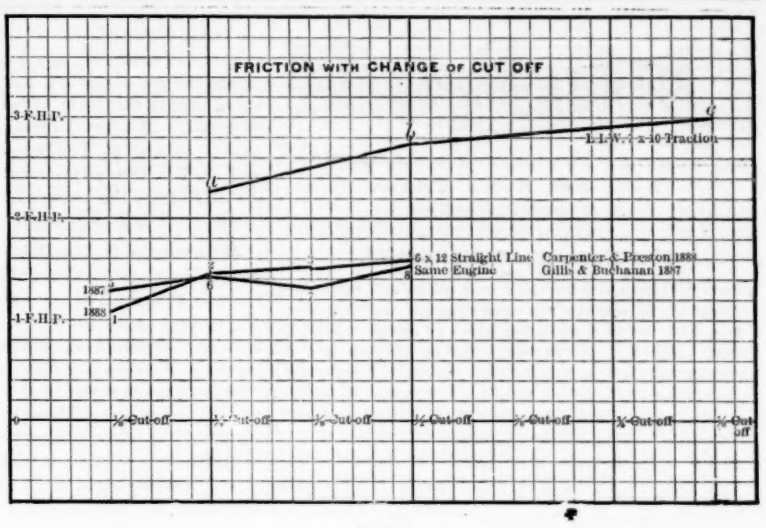


Fig. 3

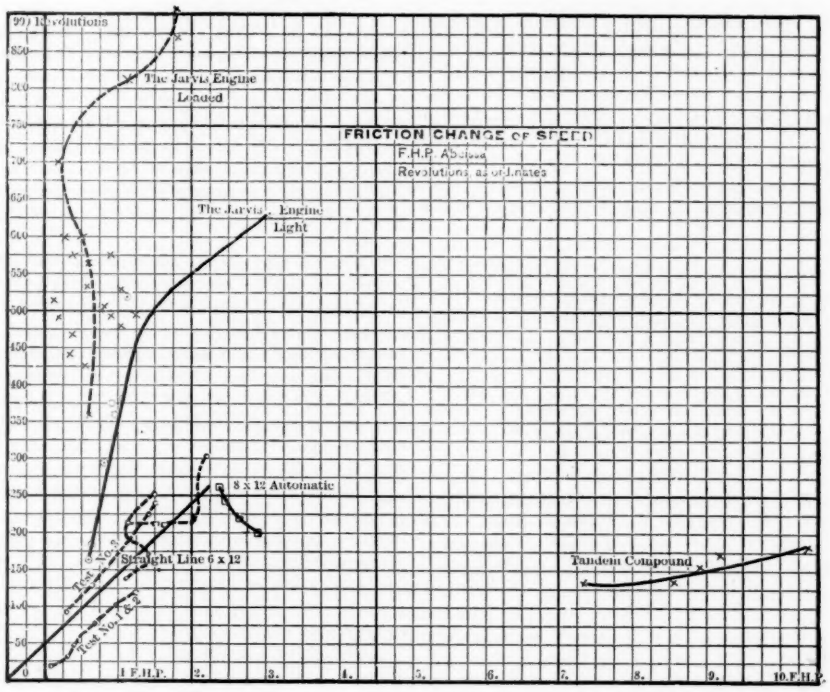


Fig. 2.

nitudes of friction, the engine having had a year's work in the interval, but the law of variation is the same and the rate of variation is nearly equal in both cases, although the friction is seen to be more nearly constant in the first set of trials."

In a diagram not reproduced here are summarized the experiments made by changing the load, or power exerted by the engines, other conditions remaining nearly constant, and although there are considerable variations from the main lines, the diagram indicates that the effect of change of load in modifying friction is at best very slight.

Several of the engines of which accounts are here given were tested for the friction of the separate parts of their mechanism by dismantling them and actuating them by a belt, measuring the power exerted by means of a transmitting dynamometer. In these experiments only engines whose friction was practically constant at all loads were used; and the conditions of actual practice were observed as far as possible, the cylinders being heated by steam when measuring the friction of pistons and piston-rods, and pressure being applied when testing the friction of unbalanced valves. The following table, compiled from the data given in this paper, shows the average results obtained.

In discussing the experiments the writer calls attention to the fact that the thermodynamic efficiency of the steam engine is capable of but little improvement, so that the importance of perfecting the mechanism is obvious. It will be seen that the friction of main bearings is from ⅓ to nearly ½ of the total friction, and the oil bath system or "lubrication by means of a forcing pump that should insure the support of the journal upon a cushion of lubricant" is recommended.

The valve friction, with unbalanced valves, "is seen to be hardly a less serious amount than the frictions of shaft and of piston. But it is further seen at once that this is an item which may be reduced to a very small amount by good design, as is evidenced by the fact that in the straight line engine it has been brought down from 26 to 2.5 per cent. by skillful balancing. Ninety per cent., therefore, of the friction of the unbalanced valve is avoidable or remediable."

With regard to the friction of piston and piston rod the writer remarks: "The metallic packings and the unpacked pistons and rods now coming slowly into use will unquestionably do much to remedy this defect of the average engine. Meantime, with the older design it is perfectly possible to keep piston and stuffing-box tight without wasting much power or by slowing down the engine by conversion of heat into work at points where the operation is likely to produce serious harm as well as waste. Rings are much oftener too tight than too loose, and a stuffing box should only be set up when the engine is running, and then only with fresh packing, and not more than is sufficient to check any visible leakage. New packing in a well-made box never needs much compression, and when it becomes necessary to screw it down hard, it is time to replace it by new. Any packing that requires severe compression when new should be promptly condemned."

Finally, the writer calls attention to the importance of thorough lubrication. "The more nearly most absolutely flooded the parts can be, the better, and irrespective also, to a great extent, of the cost of the lubricant."

DISTRIBUTION OF FRICTION. SUMMARY OF RESULTS.

PARTS OF ENGINE.	Straight line engine, 6×12.				Traction engine, 7×10, locomotive gear.		Automatic engine, 12×18.		Condensing engine, 21×20, balanced valve.	
	Balanced valve.		Unbalanced valve.							
	Friction. Horse-power.	Percentage of total friction...	Friction. Horse-power.	Percentage of total friction...	Friction. Horse-power.....	Percentage of total friction.....	Friction. Horse-power.....	Percentage of total friction.....	Friction. Horse-power.....	Percentage of total friction.....
Main bearings.....	.849	47.0	.849	35.4	.680	35.0	3.70	41.6	3.3	46.0
Piston and rod.....	.593	32.9	.593	25.0	.400	21.0	4.35	49.1	1.48	21.8
Crank pin.....	.123	6.8	.123	5.1	.255	13.0				
Cross head and wrist pin.....	.098	5.4	.098	4.1						
Valve and rod.....	.046	2.5	.631	26.4	.410	22.0	.83	9.3	1.47	21.0
Eccentric strap.....	.095	5.3	.095	4.0						
Link and eccentric.....					.165	9.0				
Air pump.....									.88	12.0
Total.....	1.804	100.0	2.389	100.0	1.910	100.0	8.88	100.0	7.13	100.0

TECHNICAL.

Steamers for the White Star Line.

Two new steamers for the White Star Line will be launched shortly—the "Teutonic" and the "Majestic." They are to be 625 ft. long and of 10,000 tons.

Baldwin Locomotives at the Augusta Exposition.

Following is a general description of the American type of passenger locomotive exhibited at the Augusta Exposition by the Baldwin Works. This engine was awarded one of the first prizes.

Gauge	4 ft. 9 in.
Cylinders	18 in. x 24 in.
Boiler	56 in. dia.
Driving wheels	62 in. dia.
Wheel base, total	22 ft. 10 in.
Wheel base of driving wheels	8 ft. 9 in.
Extreme length of locomotive and tender over all	55 ft. 3½ in.
Weight of engine in working order, total, about	94,000 lbs.
Weight on driving wheels about	58,000 lbs.
Weight of tender with coal and 3,000 gallons of water about	66,000 lbs.
Weight of engine and tender ready for service about	160,000 lbs.

Boiler of homogeneous cast steel; fire-box of steel; tires of steel; wristpins of steel; crossheads of steel; cab of ash. Tank plates of iron; tender frame of channel iron.

Fitted with 2 Monitor No. 8 injectors, Detroit sight feed lubricator, balanced slide valves and headlight.

Hauling capacity:	Feet per mile.	Gross tons (of 2,240 lbs.)
On a level	....	1,555
On a grade of 1 per cent	52.8	360
" " 1½ "	79.2	245
" " 2 "	105.6	170
" " 2½ "	132.0	130
" " 3 "	158.4	100

This locomotive was built on the order of the Marietta & North Georgia Railway Company, and will be placed in regular service on that road at the close of the Exposition.

Following is a general description of the steam tramway motor shown by the same works:

Gauge	4 ft. 8½ in.
Cylinders	8 in. × 12 in.
Boiler	32 in. diam.
Driving wheels	35 in. diam.
Wheel base, total	7 ft. 6 in.
Driving-wheel base	4 ft.
Length over all	14 ft. 10 in.
Weight in working order, total, about	19,000 lbs.
Weight on driving wheels, about	15,000 lbs.
Capacity of tank	200 gallons.

Suitable for rails of 16 to 20 lbs. weight per yard, well supported. Capable of traversing curves of 30-ft. radius. Boiler of homogeneous cast steel; fire-box of steel; tires of steel; tubes of lap-welded charcoal iron; wrist-pins of steel.

Fitted with two Monitor injectors, two motor headlights, steam brake, gong and all necessary tools. Muffler for suppressing noise of exhaust of Baldwin Locomotive Works' pattern.

Hauling capacity:	Feet per mile.	Gross tons (of 2,240 lbs.)
On a level	....	285
On a grade of 1 per cent	52.8	80
" " " 2 "	105.6	40
" " " 3 "	158.4	25
" " " 4 "	211.2	17

As ample reserve power is a necessary condition of noiselessness, these estimates of maximum tractive power are made without reference to entire suppression of steam. With lighter loads or on easier grades the motor would be practically noiseless. No smoke is generated if the fuel burned is anthracite coal or coke.

RAILROAD GAZETTE

Published Every Friday,
At 73 Broadway, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The paper on car wheels which Mr. Barr read at the last meeting of the New York Railroad Club is so thorough and so admirably arranged that we print it nearly in full on another page. The notes of the discussion are not yet available. Not the least interesting part of Mr. Barr's paper is the description of his contracting chill. The Whitney contracting chill was described in the *Railroad Gazette*, May 20, 1887. The two are identical in principle and do not differ greatly in detail. The inner or chilling ring is composed of a number of blocks separated by very narrow slots. These blocks are connected to the outer or supporting ring by webs, and as these webs expand by the heat communicated to them by the molten metal the blocks are carried inward, and the diameter of the inner face of the chill is contracted, and it is kept in contact for a time with the cooling metal. In the Whitney chill the outer ring is solid, but in the short time necessary to produce the chill but comparatively little heat is communicated to it, and it does not expand rapidly enough to counteract the effect of the expansion of the connecting webs. In the Barr chill the outer ring is hollow, and before the metal is poured the ring is expanded by introducing steam, and during the pouring it is contracted by introducing water in place of the steam. Thus it aids the action of the webs. This is the essential difference between the two contracting chills. In the discussion of the paper the point was repeatedly raised that the effect of a small stream of cold water circulating in the chamber of the outer ring would be insignificant compared with the effect of 600 pounds of melted iron poured into the mold. So it would if both acted at the same time and place. As a matter of fact, however, the duty of the water is done before much of the heat of the wheel iron is conducted through the comparatively thin webs to the outer ring, and the Whitney chill has demonstrated that very successful results can be got without the water chamber.

The improvement in wheels made in the contracting chill, as shown by Mr. Barr's statistics, are very remarkable, but some of them were confirmed by the experience of other makers, and the others were very likely not confirmed merely because the other makers had no statistics at hand. In this particular Mr. Barr is in a fortunate position for observation, as he not only makes wheels but uses them very largely, and has a thorough system of inspection and record. He finds that on the Chicago, Milwaukee & St. Paul the average mileage of wheels drawn from passenger equipment increased from 76,000 miles in 1886 to 98,000 in 1888, or 40 per cent.; and he expects to find that, when the old wheels made in the common chill are entirely out of service, the mileage will be doubled. The mileage now obtained on the Chicago, Milwaukee & St. Paul is certainly very remarkable, but it is impossible to say, without other data than we have seen, how much the improvement is due to better mixtures and better methods of mounting and handling, and how much is due to the use of the contracting chill. It should be noted that in the table given, wheels slid flat are not included. Moreover, there are no heavy and long grades on the St. Paul's lines. The element of care and skill in the adjustment of brakes is therefore excluded from the comparison.

The struggle in Manitoba has passed into a new phase. The Supreme Court of the Dominion holds unanimously that the Portage extension of the Red River Valley may cross the lines of the Pembina Branch and the Manitoba & Southwestern Branch of the Canadian Pacific, provided the mode and place of crossing are approved by the Railway Committee of the Privy Council. These crossings were hotly contested last October in the courts and out of them, by injunctions and by force of arms. We were satisfied at the time that the delay could be but temporary, otherwise the surrender by the Canadian Pacific of its "monopoly privileges," for which it got $15,000,000, would have been a practically useless concession. If the road has been fighting for time it has gained one crop year. If it was fighting for principle it has apparently won also in establishing the rule that its tracks can only be crossed with the approval of the Dominion officials. In either view this decision cannot be looked upon as a "memorable victory" for the Province, for the Canadian Pacific claimed last October that it was contending only for the principle now announced by the court. Now it remains to see how difficult it will be to satisfy the Privy Council's committee.

We learn from Chicago men that the movement instituted by Chairman Daniels to publish passenger rate sheets quarterly instead of monthly is making hopeful progress. Mr. Daniels has published the names of 170 roads which have already expressed themselves in favor of the plan, as has been noted in these columns. These roads are, however, scattered all over the country, and not exclusively in Central Traffic Association territory, as we stated. This indicates that the movement will succeed. There can be little doubt of the value of this change simply in its legitimate effects in eliminating errors and misunderstandings, to say nothing of the economy in printing and compiling, which all interested say will be large. Uniformity in styles and arrangement is also promoted by concentrating this work in as few offices as possible. As every one knows, the Inter-state Commerce Commission desires the roads to work together harmoniously toward uniformity in all possible directions, and in the passenger, as in the freight department, uniformity of clerical features and other details helps materially toward securing uniformity in essentials. Passenger rates naturally fluctuate far less than freight rates, and there is no important reason why the comparatively trifling changes, which often give the only importance to frequent revisions of tariffs, should not be made still more trifling—that is, abolished. The habit of issuing a circular every time a thought strikes one is not one to encourage. Those who bind themselves under a rule to hold their peace about rate changes for at least three months at a time will do a good thing for themselves and for their brethren.

The railroad officer who has the courage to disclose facts which will help the public but may injuriously affect his road is probably no more common than are moral heroes in other walks of life, and we are often reminded of the fact. Failure to promptly post ticket agents concerning time-table changes is the commonest form of heedlessness, but may generally be put down to carelessness or laziness or some other form of inefficiency. Taking off sleeping cars without notice is less frequent, but more troublesome in individual cases. Dining cars offer a big temptation to the traffic man who dreads to hurt the dear public's feelings. When a "diner" has to go to the shop the G. P. A. tenderly refrains from warning passengers that they will have to go hungry until about the time that each one of them is warned by the inexpensive natural process termed "gnawing at the stomach." But when the car resumes its trips the fact is heralded from the house tops. The through train between Boston and Washington was suddenly suspended a few weeks ago, by a calamitous occurrence, but the announcement of the fact was not conspicuous. When, however, the train resumed its through trips the public knew it in ample season. A short time ago one of the best roads was accused, and apparently with justice, of adding vexation to delay by failing to inform a multitude of suburban passengers one night that they were quite sure to be delayed before proceeding more than a mile or two. A freight train had been derailed, blocking the road, and the complainant seems to think that the fear that passengers would patronize a rival road was the cause of the inactivity. To inconvenience hundreds of season passengers, whose money is secured, for the sake of getting the dimes of a few transient customers does not seem "long-headed." To post a placard announcing that the delay would be four hours might entail a loss of a few dollars; but the question is whether it is not better to sacrifice a little money than to injure one's good reputation.

The Railroad Year.

The year just closing has been in some respects a memorable one for the railroads of the United States. It followed the year of greatest railroad construction in our history, and many systems have been terribly strained by the heavy burdens assumed to build and equip a vast new mileage. It followed a year of extraordinary prosperity, and fairly good earnings of the year appear poor by comparison. It includes 12 months of the 21 that the Inter-state Commerce law has been in effect, and has given us some remarkable efforts at state control. The effects of all of these influences have been so often and so lately discussed in these columns that it would be superfluous to reiterate here what has been said. The very serious fall in the value of railroad stocks was shown in some detail in our issue of Dec. 7. The reductions in dividends are known to all, and the dullness of the stock market has been a source of constant complaint for months.

The great depression in values would not, under ordinary circumstances, have followed from the changes in results of operations which the year's business shows. The volume of traffic has been large. The gross earnings, so far as can now be determined, show an increase over 1887 of nearly four per cent. and the net earnings a loss of something like nine per cent. The earnings per mile are slightly less than in 1887, but greater than in 1886 or 1885. All of these facts show, as we have said, that the actual results of operation are not sufficient to account for the depression in values. We are led therefore to the conclusion that it is principally consequent upon uncertainty as to the effect of existing laws, fear of further and more injurious legislation and alarm about rate troubles, the importance of which has been greatly exaggerated in the public mind.

Looking at the traffic situation in detail we may say that both freight and passenger traffic have been uniformly good, the falling off in earnings, where it has occurred, being a result of lower rates. Iron ores, iron and coal have moved actively, and have kept cars busy. The wheat crop of this year is light, and export grain traffic has been small during the latter half of the year; but the corn crop is very large, and the assurance of this fact has kept general business good. The movement of freight for domestic consumption, which yearly becomes relatively larger, has therefore been such as to neutralize any falling off in export freight. The passenger men have further expanded excursion business and have doubtless run a larger number of profitable special trains than ever before and a great many more than they would have even thought of a few years ago. Rate wars have been frequent, as our readers will recollect from recent statements, but those most talked about have had the least effect on total earnings. The trunk lines began with dressed beef and cattle rates early in the year. They have carried a large share of this freight at very low rates and are still carrying it at 20 to 30 per cent. below the former stable rates. They have also carried west-bound freight at two-thirds regular rates for a month during the autumn, and emigrants at less than half price for several months, but the latter traffic was not heavy. The east-bound grain rate, which had for several months been but 20 cents, in spite of scarcity of cars, was restored at the same time with west-bound and emigrant tariffs. The trunk lines made the experiment for a month or two of publishing a tariff of through rates on grain and provisions from Western points through to European ports, but the fluctuations in ocean rates caused the failure of the plan.

The through rail route between St. Paul and the east, via the Sault Ste. Marie, was opened for business before the close of winter and was a principal cause of the Northwestern rate wars, which began in February and continued several months. Freight rates northwest of Chicago were finally restored and seem to be now well maintained, but passenger rates have been demoralized for the past month, though

now apparently restored. The action of the legislature of Iowa in reducing railroad rates and its effect on the roads is familiar to all. Local passenger rates have been reduced in Minnesota. The strike of enginemen on the Chicago, Burlington & Quincy, which began in February, and was one of the greatest interruptions to the traffic and earnings of a road ever known, put a partial stop to the rate cutting which was then going on in the Southwest, and tariffs were restored in March. Passenger competition between Chicago and the Missouri River was in speed, instead of prices, but the fast trains were taken off in the fall. They are, however, doubtless destined to go on again next season. Within the last two months Southwestern passenger rates have been seriously cut by the selling of tickets to scalpers, but harmony is restored, at least temporarily. The completion of the Denver, Texas & Fort Worth has opened a new freight route from New York (by steamer to New Orleans) to Colorado, which affects rates perceptibly, though the amount of traffic secured is not large. This and the rail line between St. Paul and the Atlantic seaboard which avoids Chicago, are examples of the influences which are accelerating the growing tendency, now favored by the long and short haul clause of the Inter-state Commerce law, to make through rates between producer and consumer regardless of intermediate distributing points, however large they may be. The opening of the Atchison, Topeka & Santa Fe's line to Chicago, and of the Chicago, Rock Island & Pacific's to Colorado, produce a similar tendency in passenger traffic, and the running of through trains between Chicago and the Pacific coast is probably not far in the future. The other new lines from Chicago southwest and northwest simply add to the number of starving paupers and help to postpone the return of prosperous traffic conditions in that region.

English roads have, during the past summer, run regular trains on 400 mile trips at speeds much higher than any before known in regular service, and the stimulus given to American roads is perceptible though the accelerations of regular trains here have not been numerous or great. Freight trains, especially those carrying live stock on competitive routes, have been run at high speed much more than ever before. This is, unfortunately, done where the air brake has not been brought into use, as well as where it has.

The uniform code of train rules has come into wide use, though not without many petty modifications. This movement, with other influences, has led to the giving of increased attention to discipline on many roads, and the intelligence of a multitude of trainmen has been quickened to a degree which cannot but be profitable to their employers. The science of train dispatching may also be said to be making progress, as also the safe management of trains generally. The New York, Lake Erie & Western and the New York, New Haven & Hartford now have, together, 110 miles of double line worked under the regular block system, and the blocking of trains at regular telegraph stations is practiced on a few single track lines. The Time Convention has also done valuable work in discussing the evils of the mileage system of settling for interchange car service and their remedy. The car accountants gathered enlightening statistics and a number of roads tried the mixed system of mileage and per diem rates for nearly a year; but it had to be abandoned, temporarily at least, for reasons which are familiar to our readers. The collection of demurrage from consignees, which, in view of the universal use of freight cars as storehouses will be necessary to a practical per diem system for interchange, has received the earnest attention of the Time Convention and of individuals, and is now under trial in many places. The almost phenomenal success of the Omaha demurrage bureau will be recalled. The accounting officers of the roads of the country have organized an association, being led thereto by the requirements of the Inter-state Commerce law.

The advance in the luxuriousness of passenger travel has not slackened. Vestibule cars are run on the through trains of a dozen roads, and electric lighting of cars is slowly increasing. Plainly-furnished sleeping cars, neater than emigrant cars, and much cheaper than palace cars, are now run daily between the Missouri River and the Pacific. The Mann Boudoir Car Company has consolidated with itself nearly all important sleeping car lines of the country outside of the Pullman and Wagner companies.

The Trunk Line Association has been little but a statistical bureau and Commissioner Fink has been in Europe on a long vacation. The Central Traffic Association has been threatened with dissolution or important modification and Commissioner Blanchard has resigned. The associations west of Chicago have been dissolved and reorganized several times.

TECHNICAL.

The automatic coupler has made very substantial progress in the year. In April the Executive Committee of the Master Car Builders' Association made public the contour lines which they had decided upon as the standard of the Association, and it became possible thereafter for the makers of automatic couplers to perfect their devices and offer them for sale, and for the railroad companies to buy them with the knowledge that the coupling faces would be uniform, and that henceforth any coupler of the M. C. B. type, made on the standard lines, would couple with any other, whatever difference there might be in locking devices and in other details. The contour lines were the result of much study by a sub-committee who had been familiar with the whole problem from the first, who had been largely instrumental in establishing the vertical plane principle, and who had pushed forward the struggle for uniformity, for close coupling and for an automatic type with constant ardor and confidence. The contour lines adopted appear to have been skillfully designed for wear and strength, and for ease in coupling. The result of the adoption of standard lines was at once seen in important orders for the M. C. B. coupler, and one great system controlling over 2,500 miles has lately issued the order for all new equipment to be fitted with it. The effort to adopt standard dimensions for stem, dead-blocks and carrier-irons was defeated in a letter ballot, 325 votes being cast in favor of the dimensions proposed and 185 against it, a two-thirds vote being necessary for adoption. It will be seen that a change of eight votes would have settled the standard dimensions. While these details still remain unsettled, and while it is still a question as to what is the best material for the knuckle, and although the buffing arrangement for use with the new coupler is not yet entirely satisfactory, the M. C. B. coupler is now in a form so perfect, and its advantages over all other types are so widely acknowledged, that its use has become now rather a commercial question than a technical one.

This has been an important year in the history of the use of the continuous brake in freight service. Nothing new has come forward that attracts serious attention, but the results of the trials and improvements of the two previous years have been seen in the great extension of the application of the air brake. In 10 months succeeding the successful journey of the 50-car train the Westinghouse Company supplied some 17,000 sets of the new quick acting brake, and of these 86 per cent. were for freight service, and it is said that there are large unfilled orders booked. We are informed that the greater part of the orders for freight brakes were from roads that had not before used them, a fact which indicates the extent to which opinion has advanced.

Train heating has for two years been the subject of much study, invention and experiment; but although in the last year it has made progress it has not advanced in anything like the same degree as has the use of the automatic coupler and the air brake. The best information that we have been able to get shows that the number of railroads which have actually adopted some system of continuous heating increased during the year from 6 to 24. These have fitted or are fitting all of their passenger equipment for heating by steam circulation from the locomotive. The number of cars so equipped is difficult to get at, but seems to be about 2,400. The fact is that the technical officers of the railroads generally do not think that any system is so perfect that it is not likely to be greatly improved, and the matter is on a very different basis from that of the coupler and the brake.

The most important change in track practice during the year has been the growing sentiment in favor of heavier rail sections. This has been marked by the adoption of an 80-lb. section on the Michigan Central, a 90-lb. section on the Reading, a 70-lb. section on the Plant lines to replace a 60-lb. rail, and by the declarations of the Roadmasters' Associations in favor of heavier sections generally.

It is well to note here the steady decline in the price of rails, which, while it has not had much to do with the use of heavier rails, has doubtless encouraged renewals. In fact, it appears now that about half the year's output must have been used in renewals. The year began with rails at $32 at the mills. The price has fallen without interruption until it now stands at $27 to $27.50.

The use of a new steel tie in an experimental way has begun on the New York Central & Hudson River, under conditions very favorable to a good test of its qualities. On the other hand, an iron tie that had been tried for some years in a small way on the Pennsylvania, has been given up. The experiment of the latter road with English permanent way has fairly begun during the year, but is not at all likely to produce any change in track practice. So far, the lesson which appears to have been derived from it is that the use of a plate of some kind under the rail is desirable, and we see signs of a considerable interest in this detail.

The results of the year in car and locomotive building will be treated in a later issue.

In railroad bridge work the year has been remarkable for the completion and the beginning of an unusual number of heavy and long bridges, and it is probable that in the amount of heavy bridge work done it has surpassed any previous year. It would be out of place here to attempt to make a complete list of the great structures which will make the year a memorable one in this branch of engineering, but we may mention the Poughkeepsie bridge, connected recently, which has five spans of from 525 to 548 ft. each, and a total length of 6,667 ft. including approaches; the Sioux City bridge, just opened, having four spans of 400 ft. each; the Arthur Kill draw-span, 496 ft. long, swung last June, the Cincinnati and Covington bridge, just opened, having two spans of 490 ft. each and one of 550 feet, the longest simple truss ever erected; the Cairo bridge, having two spans of 523 ft. each, and seven of over 400 ft., the erection of which was begun this season, and is now fast approaching completion, and the Memphis bridge with a span of 791 ft. This last will be remarkable, not only as having the longest trussed span in the world, after the Forth bridge, but as being the first bridge across the Mississippi below the mouth of the Missouri.

Causes of Depreciation of Railroad Property.

Our article of Dec. 7, on "Railroad Values Under the Inter-state Commerce Act," has called forth protests from several quarters. One of these we publish this issue; another appears as a communication to the to the last number of *Bradstreet's*.

We cannot see that the force of our conclusions is seriously weakened by either of these articles. We showed that there had been a serious fall in railroad values since the Inter-state Commerce Act was in operation; that this differed from similar movements in the past, because it was peculiar to railroad property instead of being part of a general commercial depression; and finally, that the causes cited by the Commission to explain this movement were themselves to a great extent results of the act itself. Neither the first nor the second of these points is seriously questioned by our critics. The writer in *Bradstreet's* understates the extent of the movement, attributing it to some thirty selected roads, instead of to a general presentation of a much larger number; but this was obviously an oversight on his part. Our facts thus far are not questioned, even by those who disagree with our explanation. There has been a large general fall in railroad values, due to causes peculiar to railroad business.

We now come to the third and more difficult point, What were those causes?

At the beginning of the year 1887 the Inter-state Commerce act was passed. A large number of its supporters voted for it because they believed that it was going to reduce railroad rates, rather than from any detailed ideas as to the abuses to be corrected. The extremists were not able to enforce their view to the fullest extent; but they were able to put in some of the provisions which they most desired. At the time when the act was under discussion it was predicted that the law would have the results which have made themselves felt. In our issue of Jan. 14, 1887, we expressed ourselves clearly on this point. The law was passed, and was in due time followed by serious abuses and by a fall in railroad values. Under the circumstances it is natural to suppose that the law caused the results. Our critics urge that similar results were not infrequent in times past, and that a number of special causes have arisen to make special trouble just at present. We are told that "the pool was never an adequate preventive" against rate wars. Very true. The pool was never allowed sufficient legal recognition to give it adequate power for the purpose. In those countries where it has been given adequate powers, it has proved an adequate preventive. Where it has been tolerated, it has proved a partial preventive. Now that it is totally forbidden, we have no preventive at all, short of actual consolidation.

We have little patience with the present outcry about the rottenness of railroad morals. Of course there are bad men and there are unwise men in the railroad service, just as there are anywhere else; but

we feel sure that the majority of railroad agents are faithful and competent, and try to do as well as their circumstances will permit. If they are not doing so well now as they were two years ago, it is hardly to be supposed that there has been an epidemic of moral degradation. It is natural to assume that circumstances are less favorable to right action, and give the wrong-doers a far greater chance to dictate the policy of the whole system. We said two years ago that this would be the effect of the law if it were passed. The law was passed; the facts are as predicted. The part of the Commission's report which we criticised was written in apparent ignorance of existing facts with regard to rebates. Mr. Adams has himself exposed the fallacy of some of the statements with regard to the absence of evidence of anything wrong; and there seems to be no doubt that Judge Cooley himself has changed his mind about the facts, if not about the explanation.

The prohibition of pools was intended by the majority of those who favored it to make the maintenance of rate agreements more difficult; in other words, to increase the liability to their violation. That it has had that effect we see not the slightest reason to doubt. How far it may have been responsible for the increase of railroad construction is more fairly open to question. We did not mean to assume that it had caused anything like the whole increase. It is not the whole 12,000 miles built in 1887 which have produced the depression, but the existence of some 2,000 miles, more or less. Anything which has a tendency, however slight, to increase this amount, will usually have a much more marked effect on the financial results. That the absence of stable agreements has this tendency seems to us clear. We cannot conceive why the writer in *Bradstreet's* should say that it tends to stop it. When can he find a year of railroad depression accompanied by anything like the amount of new construction which is going on at present? If he will take the trouble to look into the history of European railroads, where the pooling experiments have been carried much farther than here, he will find that permanent agreements have tended to check new construction, while their absence has been accompanied by a marked, and often disastrous, increase of such construction.

But even if we admit the difficulties of proof as to this last point, the case against our critics seems to us thoroughly strong. At the beginning of 1 887 the rail roads of the country were fairly prosperous. A law was passed to check their power. Its most strenuous advocates hoped that it would have certain results in the way of railroad competition. Its opponents feared those results, and predicted destructive rate wars and depreciation in values. These predictions have been fulfilled. Are we to believe that this was due to extraneous causes, or to the total depravity of railroad agents? It seems much more sensible to attribute it to the operations of the law itself.

English Accidents.

The report of accidents on the railroads of Great Britain for the nine months ending Sept. 30 is at hand. Train accidents have, during the nine months, caused the death of 11 passengers and 5 employés. Sixty-three passengers and 270 employés have been killed from other causes, and 299 other persons have been killed at highway crossings and while trespassing on railroad grounds, etc., making a total of 648 persons killed on railroad premises. Of the special reports of the more important train accidents between July 1 and Oct. 1, there are 17, four of the accidents being on one road. We summarize these reports below.

At Bow Street Station, on the Cambrian Railway, an express train was derailed as it passed out of a station loop on to the single track main line. The loop is for the purpose of running the north-bound and south-bound trains to separate platforms, and a split switch is weighted so as to stand right for down trains. Trains in the opposite direction push the rails apart as they pass through them. There are semaphore signals on each side, interlocked with the locking bar of the switch. In this case a lad of 18 years, who was the station agent's only assistant and who had been employed by the company only about four months, gave the signal to the train to pull out through the switch, and then immediately after the engine had passed the signal, which is some distance from the switch, threw it to danger and pulled the conflicting signal for a train in the opposite direction. This locked the switch so that the wheels of the engine could not crowd it open. The boy had been on duty 12 hours. Colonel Rich says the station agent should have attended to this duty and recommends the road to introduce modern improved interlocking.

At Deakin's Siding, near Winsford, on the Cheshire Lines Committee Railway, a mixed train ran over a misplaced switch and into some freight cars standing on the side track, damaging several cars and wrecking one or two. The switch was a common one, there being no semaphore or distant signal, or interlocking of any kind. It appears that the engine of this train had, about an hour before, been doing some switching at this siding, which was 2,000 ft. from the station, and the men had left the switch wrong when returning to the station. The person at fault was an inexperienced lad, and the guard is censured for not attending to the business himself. The regular switchman was engaged at the station in unloading some fish which this same engine had brought in, and the station master is blamed for not having provided other help for the unloading, which did not take more than 10 minutes. Colonel Rich recommends the road to rearrange, re-signal and interlock its sidings, and states that many sidings and junctions have been constructed since the opening of the road without the approval of the Board of Trade.

Near Thorpe Junction, on the Great Eastern, a passenger train was derailed and overturned in the ditch while running around a curve of 2,200 ft. radius. The track consisted of 80-lb. bull-head rails, 30 ft. long, in 42-lb. chairs. The sleepers were 8 ft. 11 in. × 5 in., and there were eleven of them to each 30-ft rail. The inspector found the track in fairly good condition, except that the superelevation of the outer rail varied from 1¼ to 4¼ in. He attributes the derailment to the oscillation in the engine, which was a six-wheel tank engine, weighing 38½ tons, on a wheel base of 14 ft. The centre of the boiler was 6½ ft. above the rail level, and the side water tanks were in such position that oscillation when once set up would increase. Five out of the 12 spring plates of the left leading spring were fractured, and some of them may have been broken before the accident. The speed was also too high, probably 40 miles an hour.

Near Whitehall Junction, March, on the Great Eastern, a special passenger train ran into a freight engine standing foul of its track at the junction. Both engines and several cars were derailed. There are several junctions in this locality and numerous sharp curves; the signals are difficult to see, and signals of different towers overlap each other. The signalman made a mistake, giving a clear signal to the passenger train, although the freight engine was standing within 300 ft. of him in plain sight. The inspector, Major Marindin, however, lays chief stress on the necessity of moving some of the signals and electrically interlocking those of adjoining towers, so as to provide more perfect protection. It would also be desirable to have the signalman more particularly advised by telegraph of the class and destination of trains approaching him.

At Hornsey, on the Great Northern, a freight train of 35 loaded cars ran past a home signal and into the buffer stops of a blind siding at about 20 miles per hour. The engineer was killed and two other persons injured. The engineer who was killed mistook the signal of the down slow line for that of the down through freight line, on which he was running. He probably thought for the moment that he was on the slow line. He was of 16 years' experience and a sober man. He had run only occasionally on this portion of the line. His fireman had worked with him only three days and had run upon this portion of the line but once or twice. A red hand-signal from the signalman in the tower was the first warning that either of them saw. If the signalman had realized the danger in season he might have changed the switch, but he had only time after observing the high speed to slide down the stair rail and escape from his cabin. The derailed cars broke the signal wires, so that the signals automatically flew to danger and stopped a passenger train approaching on another track. The inspector, Gen. Hutchinson continues:

The occurrence of this collision raises the question as to whether it is not desirable to make some distinction between the signals for fast, slow and goods lines where these lines are running close together. Up to within a recent period the Great Northern Railway Co., who have always been very ready to adopt improvements in signal arrangements, distinguished the slow from the fast line signals by putting rings on the arms of the former. They inform me that on the opening of the additional goods lines in the neighborhood of London, trains had so often to be turned from one kind of line to another, that the rings on the arms became conflicting and misleading, and that they considered that there was no alternative but to remove them. The use of rings is still common among most of the larger railway companies for the purpose of distinguishing slow or goods line signals from fast line signals, and I cannot help thinking that the Great Northern Co. were a little hasty in removing these rings. The subject of placing distinguishing marks on signals is, I believe, now under consideration at the Superintendents' Conference.

The running of heavy freight trains at the rate of 25 miles an hour with very poor braking power seems not to engage the attention of the inspector.

At Kintore, on the Great Northern of Scotland, the 12 rear cars of a freight train, which, with a caboose, were left standing on a grade while some switching was being done, ran back down the grade and into a station building at the foot of the hill, killing two passengers who were in the caboose. It was in the evening, and it appears that the passengers, who had been drinking, though they were not unfit to be accepted as passengers, must have let off the brake, though the brakeman told them not to meddle with it. The passengers could easily have stopped the train after it started, but the inspector thinks that they probably screwed the brake off instead of on, as has been sometimes done by brakemen. The practice of carrying passengers in the caboose is deprecated, and the road should seriously consider whether it should not be wholly forbidden. Station agents are given special tickets containing a release from liability to be signed by the passenger; these are bought by passengers desiring to travel when passenger trains will not accommodate them. The inspector remarks that the siding where this switching was done would not now be sanctioned by the Board of Trade without additional protection, as the grade is too steep—about 23 ft. to the mile.

At Bath, on the Great Western, the engineer of a passenger train ran past a distant and a home signal and into the rear of a preceding passenger train. He had been in the service 35 years, and bears a very good character. Col. Rich therefore finds nothing to say, except that either the speed was higher than the runner estimates or else the available brake power was not promptly used. The runner appeared very much ashamed of what he had done, and could only say that he had miscalculated his speed. The collision was a very light one, but five passengers claim to have been hurt.

At Paddington (London) on the Great Western, the engineer of a passenger train about 825 feet long, running up to the platform in a head house which was 890 feet long, ran into a passenger truck standing at the end of the track. He did not see the passenger truck, although he might have done so had he been looking out carefully. He had been on duty 14 hours, which Col. Rich says was too long, though the work was not hard. The train was behind time and the inspector remarks that it was too long and heavy to keep proper time; also that there is not sufficient margin in the length of the station platform. He gives a schedule of the engineer's hours on duty, hours at work, and mileage, for a fortnight.

At Dunachton, on the Highland of Scotland, a freight car in a mixed train ran off the track, about 4 a. m., and derailed all the cars behind it, among which were 3 passenger, 1 baggage, 1 caboose and 1 Pullman sleeping car. The train was running about 35 miles an hour. The track was in good order, and Maj. Marindin finds no cause for the accident. He discusses tight and loose couplings, and remarks on the frequency of derailments of this kind in loose coupled trains as compared with those tight coupled. The running of mixed trains with passenger cars at the rear is contrary to the recommendation of the Board of Trade and the inspector continues:

A favorite argument of those who advocate the practice of running the passenger carriages at the rear of mixed trains, contrary to the recommendations of the Board of Trade, is that in the case of a collision or of an engine leaving the rails, these vehicles are to some extent safe-guarded by the goods wagons in front of them, but if this argument be worth anything, it will be safer to run goods wagons or some such vehicles at the front of every passenger train. It is not a question of relative damage consequent upon different positions of vehicles in accidents to which every train, passenger or goods, is liable, but it is a question of accidents which would not have been accidents at all, so far as the passenger carriages are concerned, and risks to which the public using mixed trains should not be exposed. On the Highland Railway there have been in the last five years as many accidents of this class as upon all the other railways in the kingdom put together, but the warnings issued by the Board of Trade on this subject have been disregarded.

At Hampton Wick, on the London & Southwestern, an empty engine started from a tower about midnight and ran about 2,100 ft. on the wrong track to the next station, where it ran into the head of a passenger train approaching from the opposite direction. The runner of the latter had seen the danger and nearly stopped. The engines were badly wrecked, and 2 passengers, 1 fireman and 1 engineer killed, and 3 passengers and 2 employés badly injured. The runner of the empty engine failed to notice that he was not passing through a cross-over track as he should have done immediately after starting, and did not discover that he was on the wrong track until he had traveled about 1,100 ft., although he had to pass two signal posts and eight telegraph poles, which were only 4½ ft. from the engine instead of 14 ft., as they would have been if the engine had been upon the proper track. The fireman claims that he was dazzled by the glare of the fire, and the engineer makes the same excuse, but they are blamed for not keeping a proper lookout. Circumstances indicate that neither the engineer nor fireman discovered his blunder until they were well within the station at Hampton Wick. The signalman did not discover what had happened until the engine had gone 1,000 ft. or so, and then was so paralyzed that he did nothing. The original cause was the blunder of the signalman, but the engine was standing in advance of all the fixed signals, and was signaled to start by a hand signal. The deficiency in the signaling arrangements should therefore be remedied at once. The signal man at Hampton Wick might have averted the collision by throwing up his signals against the empty engine, and Maj. Marindin therefore says that there ought to be some very short code of telegraphic or telephonic signals, on receipt of which the signalman would at once throw all signals to danger. The present code, which, however, was not used, requires from 6 to 20 taps on the bell, and there was in this case a difference of opinion as to which combination of signals ought to have been given.

At Hyde Junction, near Manchester, on the Manchester, Sheffield & Lincolnshire, a 4-wheeled third-class carriage in a passenger train was derailed while the train was running at high speed. It was on a very dark night, and the train ran about 1,600 ft. before it stopped. The derailed car then tilted over to one side and struck the tender of the engine (running tender-first) of a freight train going in the opposite direction. Four passengers were killed and a number seriously injured. The cause was a broken axle. One of the wheels was found to have been forced outward on its seat 1⅝ in., but this appears to have been a result of the derailment. Gen. Hutchinson examined the axle very carefully and subjected it to a series of tensile and transverse tests, but he is unable to find ground for seriously censuring its owner or maker. This road has, however, furnished 22 per cent. of the passenger axle fractures in the United Kingdom during the past five years. An axle made by the same makers caused an accident in 1884. These facts deserve the company's most serious attention. The train was a special, but had no distinguishing light at the front. If it had had one, the signalman might possibly have done more to

avert the collision. The practice of this and of other roads is to use distinguishing headlights on engines of special trains making trips of 20 miles or more. The collision would probably have been prevented had there been a bell rope. Bell ropes are required by law for trips of the length just mentioned, but Gen. Hutchinson hopes that the law will be amended to require a satisfactory means of communication on all trains. He also says that, had the carriage been a 6-wheeled instead of a 4-wheeled one the collision would probably not have occurred. The cars had automatic vacuum brake appliances, but the engine had only non-automatic. The guard knew of the derailment 900 ft. before the collision took place, so that if he had had control of the speed, as in the case of automatic brakes, he doubtless would have prevented the collision.

At Ashbury's Junction, on the same road, a special excursion train was made up on the freight tracks and started through a cross-over to take the main passenger tracks, and by a mistake of the signalman was turned on to the down instead of the up line and met an empty engine, which struck it at a speed of 15 miles an hour. One passenger was killed, and 29 injured. Although the immediate cause was the forgetfulness of the signalman, an accident of this kind, says Major Marindin, was sure to occur sooner or later. The station was not adapted for busy excursion train traffic, such as it has, and passenger trains in starting from the freight track have to move in the wrong direction for a certain distance on a main track without the necessary fixed signals. The switches were interlocked, but not correctly so. The accident happened in the night, and hundreds of trains have been so worked without accident, but this only speaks volumes for the care and attention given by the company's servants.

At Dinting Junction, on the same road, a passenger train jumped the track at the facing-point switch of a junction, which was close to a passenger platform. The trackmen say the engine jumped the guard-rail, and the locomotive superintendent thinks it was derailed at a frog. It is impossible to say which is right. Another accident occurred at the same place three weeks later, and Colonel Rich thinks the gauge was too tight on the curve leading to the branch, which was 465 ft. radius.

At Crosby Garrett Station, on the Midland, an excursion train of 19 cars being backed on to a side track to clear an express train at 1 a. m. was run into the buffer stops with considerable violence and 7 passengers injured. The siding was not long enough for the train; the rear guard discovered this when he was almost at the end of it and jumped off for the purpose of giving a red signal to the engineer to stop (night switching signals are given by color, with hand flash lamps, and not by motion). He stumbled in the darkness and had some difficulty in showing his light. The front guard, therefore, continued to show a green light and the engineer did not shut off soon enough. The rear guard, as he jumped off, shouted to a railroad man on the car to apply the brake, but as he did not mention the vacuum, the latter applied the hand brake, which was of no use, as it was already on. Nearly everybody connected with the affair is blamed. The rear guard did not take alarm at the speed as soon as he claims. The signalman, instead of watching the operations of the train, remained in the centre of his room. The guard failed to inform the signalman that the train was longer than usual, and did not inquire the length of the siding. The signalman did not concern himself about the length of the train, and he is made to bear the larger share of blame. The guards should have inquired about the length of the turnout, and the railroad man inside ought to have been sharper, but he, of course, was not at all responsible for the movement of the train. Finally, there was no occasion for setting off the train at this point, as the regular train was 18 minutes behind time.

At Clay Mills Junction, on the Midland, a long freight train ran past a home signal at a point where the freight and passenger tracks of a 4-track road converge, and was derailed and ditched by the safety switch, about 11 p. m. The home signal for the passenger and freight tracks were exactly alike and upon two posts 45 ft. high alongside each other. It appears that the engine passed the distant signal slowly, and that when it got within 600 ft. of the home signals, the home signal for the passenger track was lowered for another train; the engineer of the freight for a moment thought that he was upon the passenger line and increased his speed, discovering his error only after he had reached the safety switch and was running 20 miles an hour. The signalman showed a red hand light as soon as he saw the trouble, but the men on the engine did not see it. He would have done better to throw up his semaphores, but is not blamed for the action he took. He, however, threw up all the semaphores in season to stop the fast train approaching on the passenger track, which otherwise would have run into the derailed cars of the freight.

At Newcastle, on the Northeastern, on a dark and rainy night, a passenger train ran into an empty engine on a sharp curve. The locality of the accident is a complicated junction, and block signaling was not in effect. A semaphore signal was lowered for the empty engine, and it appears to have been observed by the runner of the passenger train (when some 900 ft. off), who assumed that it was being lowered for himself. He is not blamed for this, but as a freight train on an adjoining track obstructed his view and the home signal being at danger when he first came in sight of it, he ought to have been more careful than usual. Other collisions have happened at the same place, and if this warning is neglected a heavy responsibility will fall upon the company in case of future similar accidents. It is stated that block working has been tried and found impracticable, but Major Marindin says that the road should try it again, and adopt permissive blocking at least.

At Cannon street (London) on the Southeastern, a passenger train ran into a station too fast and struck some cars at the end of the track. The rule requires ordinary stops at places of this kind to be made with hand brakes, but the engineer seems to have been coming in at a high speed, depending upon the vacuum brake. The coupling had become disconnected and the brake therefore failed him. Had it been automatic the severance of the pipe would have caused the application of the brake. Gen. Hutchinson has noticed that the engineers of this road are somewhat in the habit of depending upon the power brakes, and says station masters and platform inspectors should keep careful watch of them, and report all disobedience of the rule.

A paper on maintenance expenses on track laid with wooden and with metal ties, by Mr. J. W. Post, Permanent Way Engineer of the Netherland State Railroad, was read at the last Annual Convention of the American Society of Civil Engineers, and appears in the *Transactions* of that body. This paper should be read by those who are studying the design of metal ties and by those who contemplate trying them. Economy of maintenance is not proved by the figures given, which have been already published in the *Railroad Gazette*, for many changes in detail have been made from time to time, and some of the types of tie and fastenings show very good results, as compared with oak ties, and some show very bad ones. On the whole, however, the company arrived at the conclusion that there is an economy in maintenance expenses with properly designed metal ties and that the track is more stable than with wood. Of course, the economy must increase with the ages of the ties, as the wood will deteriorate with increasing rapidity. The great value of the paper is its summary of the experience in designing a tie and fastenings. Mr. Post's studies have extended over several years, and he has seen hundreds of thousands of metal ties made and put in service. His observations, therefore, should be known to every one who undertakes to do a similar work.

The opinion of the Attorney-General of New York on the car-heating law, as printed in another column, is eminently sensible from a common sense point of view, whatever may come of it when tested by lawyers' technicalities. The public, of course, deserves the same protection on the New York, New Haven & Hartford as on the New York Central & Hudson River, and the law should bear upon them equally, unless the inter-state commerce provision of the constitution forbids, which it probably does not. The Attorney-General's arguments are not so sound as his conclusions. A mileage limit is in fact a most illogical condition. The New Haven road, with its fine roadbed and track, block signals, etc., is, of course, in many respects, far safer than the cheap roads which the Attorney-General refers to, and could justly complain at any terms harder than those imposed upon the latter. If low speeds, light trains, thin traffic and similar considerations are the basis of the exempting provisions, they ought to be mentioned as such in the statute.

We have received a letter from a member of the American Society of Civil Engineers suggesting the Greenbrier White Sulphur Springs, West Virginia, as the place for holding the next annual convention of the society. The first consideration which recommends this point is its convenience for Southern members, and it is also quite accessible for members from the North and from the Ohio Valley. The hotel accommodations are ample, the surroundings are attractive, and the chances of having cool weather are as good as at any other point offering the same attractions. Richmond, Va., is also suggested by various members, and would be particularly acceptable to the members from the South. There are various matters of engineering interest to see in the neighborhood, and the historic interest of the vicinity of Richmond and Petersburg would make a visit there most enjoyable to all the old soldiers of the society as well as to many of the younger members.

NEW PUBLICATIONS.

The Principles of Thermodynamics, with Special Applications to Hot Air, Gas and Steam Engines. By Robert Röntgen. Translated, revised and enlarged by A. Jay Du Bois, Ph. D. Second Edition. New York: John Wiley & Sons, 1888. 8vo, pp. xx, 707. Price, $5.

The science of thermodynamics, or the general principles relating to the phenomena of heat, is usually treated by the aid of the calculus, which indeed is the only method available for the solution of many problems. But the most important features of the subject can be presented in less complex form, using algebraic processes only. The latter mode of treatment is followed in the present work, which gives all the most important laws of thermodynamics in a simple and correct manner. The introductory portion, consisting of two lectures by Professor Verdet, is a masterly discussion of the laws of heat, of great value to the general reader. The succeeding chapters of the work contain many interesting and valuable features, including a good discussion of the principles involved in the compression of air, the theory of air engines, with practical examples, and the most thorough discussion on superheated steam published in the English language. The appendix contains numerous tables of the properties of steam and other vapors, the data being given both in English and metric measures. Throughout the whole work the examples and data are generally presented according to each system of measurement; an arrangement which will doubtless be appreciated.

The present edition contains 66 more pages than the first the new matter consisting principally of applications of the calculus to the laws governing the generation of steam, additions to the discussion of specific heat, several new practical examples, reduction of metrical data to English measures, and a number of tables relating to the properties of steam and other vapors. In its present form, the work can be recommended as valuable for purposes of instruction and reference.

Twenty Years with the Indicator. By Thomas Pray, Jr. New York: John Wiley & Sons, 1888. 8vo, pp. xvii., 284. Price, $3.

This is a revised edition of a work which was previously published in two volumes. In its present form it is more convenient for reference. It belongs to a class of books written for beginners whose experience with the use of the indicator is slight, and, being composed in simple language, with an entire absence of analytical formulas, it will doubtless be favorably received by practical men. The large number of indicator diagrams published from original data and representing results obtained from various kinds of engines, both in good and bad adjustment, furnishes texts for a series of interesting discussions. These diagrams are printed without reduction in size, which adds greatly to their value.

The author first defines the different lines of an indicator diagram, and adds directions for the use and care of the indicator. His experience leads him to recommend a certain type of indicator and the pantograph or "lazy-tongs" reducing motion; and there is little reference to other forms of indicators and reducing motions. Considerable space is devoted to discussing the desirability of taking simultaneous diagrams from both ends of the cylinder, for the purpose of observing the valve adjustment, and the use of a single connection for the two ends is condemned.

The practical hints are followed by a series of lessons in which various diagrams are presented, and their faults or excellencies considered; some of the very best diagrams ever taken, as well as some of the worst, being shown. Much of the matter contained in these lessons will be found very useful by students; but there is a large portion which should be received with considerable reserve. The author devotes many pages to the explanation and application of a "demonstration," or method of drawing the theoretical curve of expansion on an indicator diagram, when the clearance of the engine from which the diagram was taken is not known. The demonstration depends upon the fallacious principle, as announced by the author, that "the clearance, if known, would add its volume to steam used, but would in no way affect the cut-off or expansion." The effect of clearance in altering the form of the expansion line has been published so often that it is a matter of surprise to find the principle denied in the present work.

In the lessons there are many comparisons of initial pressure on the diagrams with boiler pressure as shown by steam gauge, but no hint is given to the effect that such comparisons are absolutely worthless unless indicator springs and steam gauges have previously been tested. Every engineer who has tested springs and gauges knows that corrections must be applied to one or both in the majority of cases.

The author seems to be unnecessarily severe on the use of exhaust steam for heating, because he finds in one case that excessive back pressure occurs from this cause, not considering that almost any mechanical arrangement could be condemned by the same mode of reasoning, if cases where the details were faulty should be alone examined.

The use of the planimeter for calculating the area of indicator diagram is explained, but there is no reference to the averaging instrument, or special form of planimeter, which gives mechanically the mean height of a diagram.

Preparing for Indication. By Robert Grimshaw, M. E. New York: Practical Publishing Co., 1888. 16mo, pp. 56. Price, $1.

This little work consists principally of sketches showing how the reducing lever for taking indicator diagrams should be arranged for most cases which arise in practice, and how the steam connections on the cylinder should be made. Engineers who use the indicator and find it necessary to make a sketch for each case which is presented, students who desire practical instructions, and engineers in charge of steam machinery will all find this book a useful addition to their libraries.

The swing lever or pendulum is the only reducing motion considered in this little treatise, and the only application is to direct-acting engines with cross-heads and guides, beam and oscillating engines, direct-acting pumping engines of variable stroke, trunk engines and other types being disregarded. Indeed, the author seems to consider information about indicating such engines worse than useless, as may fairly be inferred from the following remarks in the preface: "If there occur in ordinary practice any cases not covered by the following matter, I should be very glad to know of them, and will prepare matter to accommodate them, making but one exception. There is in the city of Chicago a double oscillating engine, with variable stroke. I was sent for from New York to indicate this engine, which 'stumped' me for half a day. I got the cards, but forget how, and do not wish to remember."

Portland Cement Mortars and their Decomposition by Sea Water.

We take from *The Engineer* a resumé of a memoir on the permeability of Portland cement mortars and their decomposition under the action of sea water which has been published by MM. Durand-Claye and Paul Debray in the *Annales des Ponts et Chaussées.*

On the invitation of the Commissioners for experimenting in cements, these engineers proceeded to analyze numerous samples gathered by local engineers, and endeavored to ex-

plain, by means of laboratory experiments, the accidents to which they are liable.

TABLE I.

Proportion of		Ratio of the weight of magnesia to the total weight of the lime and magnesia.	Sulphuric acid.
Magnesia.	Lime.		
0.25	13.05	0.02	0.05
0.20	13.90	0.01	0.10
0.25	11.40	0.02	0.50
0.30	10.35	0.03	0.05
0.35	9.75	0.03	0.05
1.60	8.50	0.16	0.30
0.10	10.20	0.01	0.45
0.10	10.10	0.01	0.40
0.45	11.45	0.04	0.60
2.90	5.80	0.33	0.60
3.90	4.70	0.45	0.40
0.35	11.90	0.03	0.95
0.10	9.95	0.01	0.35
0.25	11.35	0.02	0.40
2.70	6.15	0.30	0.60

Table I. gives the results of the analysis of the samples of sand concrete, applied to an equal hypothetic section of quay wall and classed in this section, descending from the summit to the foundations. This table shows that the proportions of magnesia and sulphuric acid are very variable in the different samples, which can only be explained by the action of the sea water on the basin. The samples containing the largest quantities of magnesia or sulphuric acid correspond to those parts of the quay walls which have been the most damaged. Table II. gives the analysis of the mortars extracted from the joints of the masonry of the docks in the places where the cracks were widest.

TABLE II.

Proportion of		Relation of weight of magnesia to combined weight of lime and magnesia.	Quantity of sulphuric acid.
Magnesia.	Lime.		
3.50	7.65	0.31	1.10
2.70	8.45	0.24	0.85
1.65	8.05	0.17	1.20
4.50	6.85	0.39	1.55
7.80	10.20	0.43	0.40
4.05	7.40	0.35	1.00

These results show that, in this case as in the preceding, the Portland cement mortars have been greatly affected by the sea water.

The experimenters acting on sand samples taken from the upper parts of the works, or from the walls of docks which had not been exposed to sea water, stated that the sand concretes and mortars were not only very porous, but very permeable. It should be observed that porosity is the faculty which mortars that have been exposed to the air have of absorbing a certain quantity of water when they are immersed in basins and there left for a sufficient length of time; while permeability is the faculty which blocks of mortar may have of allowing a certain quantity of water to pass through them when one of their sides has been submitted to the action of a charge of water.

After having satisfied themselves that the samples of concrete and mortar presented to them, as liable to decomposition under the action of sea water, were permeable, the experimenters produced the same effects bysubstituting solutions of salts of magnesia for sea water. The strength of the sulphate of magnesia was reduced to 6 per 1,000 in order to equalize the quantity of this salt to the proportion of it which exists in sea water, that the decomposition of the blocks might not be exaggerated. The sand concretes made with divers cements—French, English and Belgian—were therefore tried, and the same results obtained from all; only that the decomposition took place in different parts with more or less rapidity, according to the copiousness of the filtrations.

MM Durand Claye and Debray proceeded to test the filtration in the following way. They made some truncated cones of mortar, 4 centimetres high, 5 centimetres in diameter at the base, and 4 5 at the smaller end. To the bases of the cones, turned upwards, they attached long glass tubes, uniting the glasses to the cones by means of pure cement. They made thus four series of three cones of the following mixtures:

(*a*) 200 kil. of cement, 200 kil. of water to 1 m. c. of water.
(*b*) 200 " " 150 " " 1 " sand.
(*c*) 350 " " 200 " " 1 " "
350 " " 150 " " 1 " "

In each series the cones were first submitted to filtrations of pure water; secondly, to water charged with sulphate of magnesia, in a proportion of 6 per cent.; and, thirdly, to water charged with sulphate of magnesia, in a proportion of 30 per cent. The mortars being very permeable, the glasses had only to be filled to obtain sufficiently copious filtaations. These experiments lasted about twenty-five days.

It was stated generally that the cones of mortar through which the water charged with sulphate of magnesia had passed were more fissured when the proportion of cement mixed with the mortar was large than when small and the quantity of water employed small, and that the water filtered through was more impregnated with sulphate of magnesia. The analysis of these cones has led to the following conclusions: (1) The filtration of pure water had carried off a certain proportion of the lime existing in the mortars and proceeding from the cements. (2) Under the action of the waters charged with sulphate of magnesia, a part of the lime contained in the mortars disappeared, while the proportion of magnesia and the quantity of sulphuric acid increased. This system of experiment was afterwards abandoned, as it appeared inadvisable to introduce beside the mortars a covering of cement, itself subject to the influences of a nature to disguise the results sought for.

The experiments showed that whatever the nature of the filtering waters was, the filtrations, which were sometimes very abundant at first, diminished rapidly in quantity, and at the end of a short time they became, if not actually nil, at least very feeble. But, at the same time, the mass of concrete become swollen.

From the results of these experiments it would appear that there is a certain quantity of water required for each kind of mortar, which corresponds to the maximum of capacity and the minimum of permeability of the mortars. This phenomenon explains itself naturally, if it be observed that when the mortars are made the grains of cement are in the same state as the grains of sand. Now, it is known that sand which is merely damp swells and occupies a greater volume than dry sand, and, on the other hand, sinks considerably if any quantity of water is poured upon it. It is the same with the grains of cement; when the quantity of water is great, and the matter lumped together, as in the making of mortar, there remain relatively considerable distances between the grains.

MM. Durand-Claye and Debray have also made a study of the comparative action of the solutions of sulphate of magnesia and chloride of magnesium, in the proportion of 6 per cent, in two series of five experiments, in a mixture of one of cement to four of sand and 10 per cent. of water, made separately, so as to eliminate as much as possible all other influences than those of the solutions employed. The samples submitted to the action of the solutions of sulphate of magnesia broke between the 10th and 20th day of filtration, while the samples submitted to the chloride of magnesium resisted at least 60 days. The fractures of the samples tried by sulphate of magnesia were more numerous, and denoted that the action of the sulphate of magnesia was more powerful than that of the chloride of magnesium. The chemical analysis showed that the test pieces submitted to the action of sulphate of magnesia contained 0.75 to 0.80 per cent. of sulphuric acid. It is concluded from this that after the phenomenon of the double decomposition between the salts of lime and the sulphate of magnesia pointed out long ago by Vicat, a part of the sulphate of lime formed remains in the mass of mortar.

It is to this production of sulphate of lime that the experimenters attribute the phenomena of the breaking of the masonry composed of Portland cement mortar subject to the action of sea water. This analysis seems to show clearly that the lime produced by the action of the sea on the mortars is not entirely carried off by the water which circulates within the masonry walls, and that it plays an important part in the disintegration of the masonry. While the magnesia produced deposits itself in a state of milky cream, without consistency, unable to exercise any mechanical action on the masonry, the sulphate of lime is consolidated more or less completely into crystals of a nature to produce considerable disintegrating effects.

Track and Wheel Gauge.

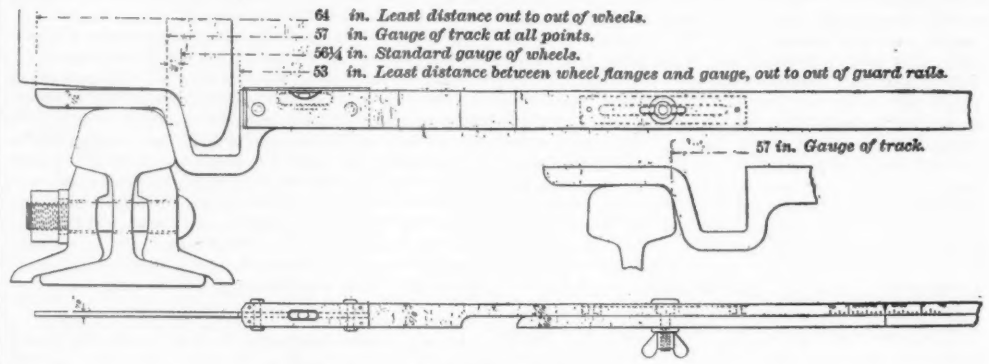
The very portable track and wheel gauge shown on this page was designed by Mr. James A. Millholland, General Manager George's Creek & Cumberland Railroad, and is shown applied to the rail designed by him and also to a rail of ordinary section.

Mr. Millholland describes the gauge as follows:

"The gauge is made of light strips of well seasoned wood, with steel ends cut from plates ⅛ in. thick; and, with spirit-level at one end and thumb-screws or clamps, only weighs 1½ lbs. altogether. With it, not only can the accurate gauge to standard and variations in track and guard rails, as well as elevations of outer rail at curves, be determined, but it also answers for determining the gauge of wheels and the inner limits between insides of flanges and out to out of treads.

"You will note that it is particularly adapted to the system I have heretofore recommended of a rail-head so proportioned as to fit the wheel in the tread near the flange and on the inside of the flange, on the lines of actual wear. The section of rail shown is that, as to side of head, top and rounded corner, which will be found, I think, pretty generally upon moderate curves, and one which I feel fully warranted in offering for serious consideration as a standard. There are many able managements, doubtless, which do not agree with me, but I feel that my suggestions will have their more serious consideration in course of time, as this important subject will be more fully discussed and the general practical experience be summed up. It is now accepted not only that wheels get into a condition of sharp flanges, but that no matter how direct the alignment of the railroad, still a wheel upon one side or the other, of any pair, becomes, by reason of its less circumference, however small, sharp-flanged by its almost constant trending to the rail; and, if the rail-head is sharply rounded on its upper corner, and has not the slope at side of head to receive somewhat of the surface of the inside of the flange, the corner of the rail will most certainly wear into the flange and cause the sharpness admitted.

"The advantage of the gauge I use is that it is adapted to the track whether the rail head is worn to the greatest slope or anything less, as the points to gauge between are the lower ends of the rounded upper corners of the insides of the rail heads. So also in gauging wheels, the corresponding points, at the lower ends of the fillets of the flanges, make the points for gauging. The sloping inside of the flange is that found to be the general wear line, and it agrees with that of the worn side of the rail heads on curves pretty generally."



MILLHOLLAND'S TRACK AND WHEEL GAUGE.

TECHNICAL.

Locomotive Building.

The Intercolonial has this year purchased 30 locomotives from the following builders: Five from Dübs & Co., Glasgow, Scotland; 20 from the Canadian Locomotive & Engine Co., Kingston, Ont.; 1 from Hinckley Locomotive Co., Boston, Mass.; 4 from Manchester Locomotive Works, Manchester, N. H. All but six of these locomotives have 18 by 24-in. cylinders and 5-ft. wheels. The cylinders of the six are 17 by 24 in.

The Schenectady Locomotive Works has delivered to the Chesapeake & Ohio road four locomotives for use on the new Cincinnati division. The engines weigh 64 tons, and have a 19 × 24 in. cylinder.

The Cincinnati, Sandusky & Cleveland has received four of the nine locomotives which were contracted for some days ago.

The Rogers Locomotive & Machine Works have this year completed 10 switching locomotives for the Lake Shore & Michigan Southern. The Brooks Locomotive Works built 5 mogul freight and 2 passenger locomotives for the same road.

The Salt Lake & Fort Douglas has received from the Lima Machine Works at Lima, O., a locomotive for working steep grades. It is fitted to work with a central rack rail.

Car Notes.

The Intercolonial has this year added 776 freight cars to its equipment, which were built by the following companies: J. Harris & Co., of St. John, N. B.; James Crossen, of Cobourg, Ont., and the Ontario Car & Foundry Co., of London, Ont. Six sleeping and three passenger cars were built by James Crossen, and seven passenger cars were built in the company's shops.

The Baltimore & Ohio has placed an order with the Pullman Car Co. for 30 new passenger cars, to be delivered before March next. The trucks of the cars will be fitted with steel tired wheels and the platforms so constructed that they can be vestibuled without removing the platforms or altering the ends of the coaches.

The Indianapolis car-works delivered last week the first 100 box cars of the order for 2,000 for the Chicago, Burlington & Quincy road. The company will now deliver them at the rate of 125 a week. The cars are of 60,000 lbs. capacity, are 34 ft. long, and are equipped with air brakes.

The Ohio Falls Car Co., of Jeffersonvile, Ind., have this year built 2,850 cars, of which 157 were for passenger service. It is expected that the output for the ensuing year will approximate twice the quantity of the year 1888, as the larger portion of the past year was taken up in making extensions and improvements in the shops.

The Cumberland Valley road has added the following rolling stock to its equipment during the calendar year. Built at the shops of the company: Fifty box cars, 60,000 lbs. capacity, and two passenger cars; built by the Carlisle Mfg Co., of Carlisle, Pa., 50 Gondala cars of 60,000 lbs. capacity. Two freight locomotives have been purchased from the Pennsylvania.

At the Montreal shops of the Grand Trunk, 188 freight cars have been built this year.

Bridge Notes.

The Cumberland County Board of Freeholders have accepted the new bridge ever Maurice River, at Mauricetown, N. Y., from the builders, Dean & Westbrook. The contract price was $44,800.

The City Engineer of Buffalo has opened bids for building a bridge (without the approaches) at West avenue. Berlin Bridge Co., $9,777; Rochester Bridge & Iron Works, $9,900. For the abutments and approaches the following bids were opened: William Franklin, $21,000; Peter G. Straub, $24,447; D. W. McConnell, $26,723; Albert Krause, $29,306; George Martin, $31,500.

The Supervisors of Sonoma County, Cal., have let the contract for a bridge across Russian River, to the King Iron Bridge Co., of Cleveland, O., for $20,350.

A company has been formed to build a bridge to cost $50,000 between Sioux City, Ia., and Covington, Neb.

The Chesapeake & Ohio bridge at Cincinnati was finished and used Dec. 25, a week in advance of the time set for its completion.

The Atlanta Bridge Co. has the contract for building the bridges over the Flint and Chattahoochee rivers for the Alabama Midland road. Each of these structures will have a draw of 230 ft.

A contract has been let for building an iron bridge with a 150 ft. span across the Little Sioux, at Spencer, Ia.

Manufacturing and Business.

The works of the Straight Fibre Iron Co., in the southern suburbs of Chicago, Ill., were burned last week. The building had just been completed.

The Betts Machine Co., of Wilmington, Del., has recently shipped an improved horizontal boring and drilling machine to the Louisville & Nashville shops, at Decatur, Ala.; one 60-in. planer weighing 36,000 lbs., to William Deacon, San Francisco, Cal; one 10 × 16 ft. boring and turning mill, 62,000 lbs. to the Bouton Foundry Co., Chicago, Ill., and will ship in a few days two heavy frog planers, 60,000 lbs. to the Ramapo Iron Works, Hillburn, N. Y.; one 7 × 10 ft. boring and turning mill, 34,000 lbs. to Byron Jackson, San Francisco, Cal., and a 48-in. radial drill to Williamsport parties.

The Indianapolis Bolt & Machine Co. is so pressed with work that it is working over-time. It has orders for nearly 2,000,000 bolts of all sizes, a large portion of them going to car-works. It also has an order for 1,000 Palmerton wrecking frogs.

D. A. Hopkins, of New York, has just received a contract from the New York, Lake Erie & Western to furnish all the brass castings for its entire system.

The Lockwood Manufacturing Co., of East Boston, Mass., will erect a large structure on the site of the burned

machine works on Sumner Street. The new plant will include machine and repair works which will probably have a frontage of 100 ft.

The Amoskeag Manufacturing Co., at Manchester, N. H., will build a new machine shop.

The Fairbanks Scale Co., at St. Johnsbury, Vt., has recently fitted all its boilers to use crude petroleum instead of coal for fuel.

The Laconia (N. H.) Car Co., has ordered a 9 arc light dynamo for its shops.

The Detroit Spiral Tube Co. has been organized to manufacture metallic tubes, tanks, reservoirs and pressed sheet and plate metal work in Detroit. The capital stock is $100,000, and the incorporators are Wells M. Leggett, Edward C. Van Husen and J. Murray Brown.

The Pintsch system of lighting cars by gas is to be applied by the Safety Car Heating Co. to 58 cars of the Wagner Palace Car Co.

The Abendroth & Root Manufacturing Co., 28 Cliff street, New York city, are at present engaged on a large boiler plant, aggregating 3,200 H. P., for the Edison Electric Light Co. A 500 H. P. plant is under way for the Tide-Water Pipe Line Co., of Bayonne, N. J., besides many smaller contracts.

Since the Indianapolis Car & Mfg. Co. completed the addition to its foundry, it is turning out 225 car wheels a day, and, as it is using under new cars but 150 a day, the company is selling to roads in the neighboring states 2,500 car wheels a month.

The Indianapolis Frog & Supply Co. is furnishing the Cincinnati, Indianapolis, St. Louis & Chicago road with a large number of the Witty patent switch stands.

The Kansas City, Memphis & Birmingham has purchased two of the Hart-Wood switches for use in the yards at Birmingham, Ala.

The Alabama Great Southern machine shops and roundhouse are now lighted with arc electric lamps.

The following two companies have been chartered in Illinois. The Chicago Car-Brake Co., of Chicago; capital stock, $200,000; for the manufacture of car-brake attachments: incorporators, J. N. Young, G. B. Quigg, and Edward Lewis. The Brownley Brakeshoe Co., of Chicago; capital stock, $200,000; for the manufacture of brakeshoes, anti-friction bushings, and kindred appliances; incorporators, J. K. Allen, M. S. L. Richey, and L. P. Concver.

A car has been built at the shops of the Keith Mfg. Co., at Sagamore, Mass., which has its top, bottom, sides and ends packed with non-conducting material to render the car frost proof. It is proposed to transfer perishable freight and produce in it without a fire, depending upon retention of the heat from a temporary stove placed in the car while it is being loaded.

As a result of the recent lease of the Louisville Southern to the Louisville, New Albany & Chicago, the shops will be shortly removed from Harrodsburg, Ky., where they were but recently located, to New Albany, Ind.

The Philadelphia & Reading is building twenty-five snowplows.

Iron and Steel.

The new steel plant of the Phœnix Iron Co., at Phœnixville, Pa., is now completed and in operation. The engines weigh 370,000 lbs. and the roll trains weigh 400,000 lbs. The plant is expected to turn out steel suitable for armoring cruisers for the Government and for making steel guns of any calibre. It has been erected on the site of part of the old iron works, and consists of two 15-ton open-hearth furnaces, arranged for additional furnaces when required; one 30-ton ladle crane, two 10-ton ingot cranes and a massive ingot extractor.

The Burlington Iron Co. has filed articles of incorporation in New Jersey. The incorporators are Edward Cohn, Joseph E. Roberts and E. Ambler Armstrong, of Camden.

The Pottstown Iron Co., of Pottstown, Pa., closed its nail factory this week. The company about three weeks ago suggested that the men agree to a reduction of wages for them, selves. No action was taken by the men, hence the action of the company. It is thought the company will now fix a lower rate of wages, and resume with men who may accept it.

The foundation for the new blast furnace of Laughlin & Co., at Pittsburgh, is finished, and the iron work is being put up. It is expected that the entire plant will be completed by May 1.

The Burden Iron Co., at South Troy, N. Y., has completed a new building 322 by 62 ft. and is putting in three new machines.

Jones & Laughlins, of Pittsburgh, have contracted for the iron work to be used in the new Chamber of Commerce, at Chicago. About 15,000 tons of steel beams, wrought-iron girders and other wrought-iron and steel work will be required. The whole contract will amount to something over $500,000.

The Great Western Steel Rolling Mill & Steel Wire Co., with a capital of $200,000, is to erect a factory at Randolph, near Kansas City. Edwin A. Beers, of Springfield, Mo., is President. The company will manufacture merchant iron, iron nails, steel wire, iron and steel rods and barb wire. The company has a new process for converting old steel rails into steel wire and steel rods, invented by N. S. Reynolds, who will have charge of this department.

Bids have been opened by the Chief of Ordnance for supplying complete sets of rough-finished, oil-tempered and annealed steel forgings of American manufacture for 8-in., 10-in. and 12-in. guns. The bids were as follow-: The Midvale Steel Co., of Philadelphia, for the 8-in., 29c. a lb.; 10-in. 30c., and 12-in.. 31c., and the Bethlehem Iron Co., 8-in., 29c a lb.; 10-in., 26½c. a lb., and 12-in., 27½c. a lb. The contract was awarded to the latter company. There is an appropriation of $1 455,000 for this purpose.

The contract for the manufacture of two 10-in. steel guns for the army has been awarded to the Midvale Steel Co. at the rate of 85 cents per pound. The guns are to be completed in six months.

The Rail Market.

Steel Rails.—There are inquiries in the market from the South, aggregating about 30,000 tons, but actual sales have been confined to a few small lots. The quotation at Eastern mills is $28, with charges that it is being cut, but the charges are emphatically denied.

Old Rails—No sales are reported, but a lot of 500 tons is offered at $23 50 from store.

Track Fastenings.—Quotations: Spikes, 2.10@2.15c.; angle bars, 1.85c. delivered.

Continuous Heating in New York State.

In reply to arguments of the attorney for the New York, New Haven & Hartford road for exemption of that road from the operations of the law regarding the heating of passenger cars other than by coal stoves, on account of the road having but fifty miles of track in the state, Attorney-General Tabor has returned the following opinion: "It seems quite clear to me that the statute is a remedial one for the benefit of the traveling public, and must be construed liberally, with a view to the beneficial end proposed, the suppression of a mischief and the advancement of a remedy. The power of the legislature does not extend beyond the state line. It is broad enough, however, to impose any reasonable requirement or regulation upon any corporation doing business within this state. The exemption from the provisions of the act of railroads less than 50 miles in length, must be construed as a reasonable one if possible. Roads less than 50 miles in length, as a general rule, have no night trains, run no sleeping cars, and under reasonably intelligent management are not liable to dangers by way of collision or disarranged schedule. Such railroads are not very liable to the accidents out of which have arisen the evils which this statute was intended to remedy. Such evils are, however, liable to occur on any trunk line. As I construe the statute the legislature meant to give to any person becoming a passenger and intending to ride more than 50 miles upon any line of railroad running in whole or in part in the state of New York the protection against accident from fire, within the state, which the statute provides. I am, therefore, constrained by my construction of the act and my conviction of duty to inform you that I shall take proceeding against the New York, New Haven & Hartford Railroad Co. to enforce, if possible, their compliance with the law."

Car Heating and Lighting Notes.

A car on an Illinois Central train near Tuscola, Ill., Dec. 22, was filled with steam by the explosion of a hot water pipe, and some passengers were injured in the panic which resulted, all attempting to get out of the car at once.

James Emerson, whose system of continuous steam heating of passenger cars has been used on the Connecticut River road for a year, has lately perfected a plan for connecting his system with the pipes of the Baker heater. He makes the connection for $45 per car, and has a contract for applying his device to 100 cars of a road not named. He is to fit up a car for a Boston road.

It is stated that the expenses for battery connections, jars, etc., for the Julien storage batteries used on the twelve Boston & Albany passenger cars, has been for the last six months $266, which is regarded as a low figure.

The Railway Electric Car Lighting & Signal Co., of 120 Broadway, New York city, which controls the electric lighting system of S. H. Barrett, which has been used on the Connecticut River road for over a year, has issued a neat pamphlet descriptive of its plans and methods. Mr. Barrett also makes an electrical train signal.

Coal Production.

The Tennessee Coal & Iron Co. is producing large quantities of coal at present, and its facilties are taxed to fill the orders now in hand. In one day the out-put from the mine of the Pratt division was 4,402 tons, the largest production on record from one mine for one day. The out put from this mine averages 4,000 tons per day, that from the mines at Tracy City 1,500 tons, and from the Sequatchie Valley 500 tons. The output from the latter has been nearly doubled in the last three months by two new furnaces having been put in blast, and another will be blown in next month, making ten furnaces which the company will then have in operation, from which about 1,000 tons of pig-iron per day will be turned out. The production of coal from all the mines of the company was 125,000 tons in October and 130,000 tons in November, while for December the total will be considerably heavier. The company has been sending the greater part of its iron to markets west of the Alleghanies, but some also to Philadelphia, New York, Boston and other Eastern points.

The Blocton coal mines at Woodstock, Ala., which have been closed for three months, commenced operations again last week. The first shipment of coal from the mines since the resumption of work was made last week.

The Roberts Tracklaying Machine.

This machine was used in the construction of the Green River branch of the Northern Pacific Railroad. Much of the work was done on the mountain grades where extra heavy ties were used and at different times with a force of from 12 to 22 men engaged in operating it. From two and a half to three miles of track were laid per day.

The machine is described by the inventor as follows: The steel and ties are conveyed on rollers, mounted on frames, which depend on trusses from the sides of the cars of the construction train. Motive power for the tram rolls is furnished by a small oscillating engine mounted on the pilot car. When in operation the tie tram runs throughout the length of the train of nine cars or less, and the rail trams run back only as far as the steel cars. The trams or frames carrying the rolls are made in detached sections about 32 ft. each. A strong frame extends out 20 ft in advance of the pilot car on the fill, and bears a circular traveler which lays the steel. The steel is set to gauge by its own weight. The entire machine is simple in construction, and easily repaired. The machinery works so easily that but 40 lbs. steam pressure is required to operate the loaded conveyors.

While the tracklayer was at work on the Green River line Mr. F. M. Haines, the engineer in charge of construction of that branch, bought an interest in it, and Roberts, Haines & Co. propose at an early date to erect shops for its manufacture probably at either Tacoma or Ellensburgh.

Vestibules in England.

The first vestibuled train of Pullman cars on the London, Brighton & South Coast made its initial trip on Dec. 10. The cars are lighted by electricity on Mr. Stroudley's system.

Ferro-Aluminum.

The Cowles Electric Smelting & Aluminum Co. states in a recent circular that it has produced in the last three months ferro-aluminum sufficient for five million pounds of castings. The Cowles Co. now sells ferro-aluminum at 26 to 30 cents per pound, depending on the per cent. of aluminum, and the additional cost per pound of castings made is about 0.13 cent.

This alloy is made by adding to the purest commercial iron that can be obtained from one-tenth to one-twelfth of its weight of aluminum. In use this alloy is crushed to small size and placed in a hot ladle, and on it is poured the molten iron. The smaller the metal is crushed the easier it melts. The alloy melts and incorporates itself with the iron, rendering it very fluid, and decomposing the occluded gas. This decomposition produces a light slag, which at once rises to the surface, leaving a very fluid bath free from gas. In making the best quality of steel castings one pound of aluminum is added to 1,000 lbs. of steel (that is, 10 lbs. of ferro-aluminum containing 10 per cent. aluminum or 12 lbs. of ferro-aluminum containing 8⅓ per cent. aluminum). If the desired effect is only the prevention of blow-holes in cast iron one-half this amount is sufficient. By adding the first amount, more aluminum remains in the iron. The aluminum that prevent the blow-holes, does it by combining chemically with the gas which forms the holes, and therefore no longer exists as metallic aluminum.

English Iron and Steel Exports for Eleven Months.

The Board of Trade returns for November show that for the first eleven months of this year the exports of iron and steel from Great Britain have been 3,671,523 tons; this is 125,142 tons, or about 3 per cent., less than in the eleven months of 1887. But the exports, on the whole, are more satisfactory, as the enormous shipments, 926,918 tons, to this country in that year were largely pig, old iron, railroad iron and unwrought steel, at an average price of from 40 to 80 shillings per ton. This year the exports to this country have decreased by 657,741 tons, which amount has been partially replaced by an increase of shipments to other countries of 532,609 tons, which *Ryland's Iron Trade* circular says consists of bars, hoops, sheets and railroad iron at an average price of 110 to 150 shillings per ton; and while the total quantity exported has decreased 3.3 per cent. the value has increased 6.5 per cent. A portion of this increase, however, is due to a rise in price, commencing in September. There has been an increase in the exports to this country in the following items, viz.:

	Tons.	Tons.
Bar angle and rod iron	of 528 to	4,236
Hoops, sheets, etc.	" 14,386 "	45,074
Cast and wrought iron	" 1,784 "	5,527
Tin plates and sheets	" 23,995 "	271,037

It is noticeable that the exportation of steel rails to this country has been 45,865 tons, and that for the month of November 4,397 tons were sent here.

Steel Rails in 1888.

It is estimated by the *American Manufacturer* that the sales of steel rails in this country will amount, by the close of the present month, to about 1,500,000 tons, a quantity sufficient to lay over 15,000 miles with 60-lb. rails. This probably means that some 7,000 or 8,000 miles of road will have been relaid. The difference in prices between old iron rails and new steel rails has had much to do with this increased demand. The miles of iron and steel rails in tracks for the past five years, as reported in "Poor's Manual," are given below with the average price per ton of steel rails:

Year.	Miles of track—Iron rails.	Miles of track—Steel rails.	Average price of steel rails.
1883	70,602	78,491	$37.75
1884	66,254	90,243	30.75
1885	62,495	98,102	28.50
1886	62,324	105,724	34.50
1887	60,387	128,959	37.08

The late purchases will not, of course, appear in the track relaid in 1888, but it is probable the track laid with steel will be greater for this year than for any previous year. When the purchases of this year are laid in the track some 54,000 miles of iron rails will still remain, requiring over 5,000,000 tons of steel rails for renewals, on the supposition that 60-lb. rails will be used. As the manufacture of iron rails for railroad use virtually ceased in this country in 1883, all of the iron rails must be five years old, and there are patches of exceptionally good rails that may be three or four times as old as this. But nearly all of these not laid in sidings must be replaced within the next five years.

Ore and Coal Docks on the Lakes.

Leading Pittsburgh manufacturers, among whom are B. F. Jones, J. W. Chalfant, M. K. Moorehead, Jas. Laughlin, Jr., and W. C. Quincy, are forming a dock company to build docks on Lake Erie at Cleveland and Ashtabula, to facilitate the handling of ore. In the same line of enterprise are three large docks to be built at West Superior, one of which will be the largest coal dock on the chain of lakes. Another is for the Ohio Coal Co., and a third for the Eastern Minnesota Railroad.

THE SCRAP HEAP.

Notes.

The Chicago police have arrested nine men implicated in robberies of freight cars on the Louisville, New Albany & Chicago.

The Order of Railway Conductors held a meeting at Providence, R. I., last week. Five hundred members were present, and the meeting was addressed by the Governor of the state and Mr. J. B. Gardiner, Superintendent of the New York, Providence & Boston.

The Denver & Rio Grande has an instruction car which is now going over the road carrying instructors in the working of air brakes, and examiners who test the men for color-blindness.

The "favors" of the Colorado Midland passenger department to ticket agents of foreign lines this year consist of cabinets containing 27 specimens of Rocky Mountain minerals. Whether the percentage of gold in these ores is as large as that in the commission remittances of rival lines is not stated.

The threatened strike of enginemen on the Southern Pacific is said to have subsided.

The express car in a Central Pacific train was robbed on the night of Dec. 24 near Clipper Gap west of Colfax, Cal. The robbers in some way got at the side doors while the train was in motion.

The recently published statement to the effect that the employés of the Philadelphia & Reading have made strong objection to the relief association recently instituted by the company seem to have little foundation in fact. The assertion that the membership is compulsory in any sense is denied by the officers of the road. A large share of the employés joined the association and have been in it a month.

President Stickney on Railroad Mora's.

At the meeting of the managers of the roads of the Western Association in Chicago last week, President A. B. Stickney, of the Chicago, St. Paul & Kansas City, made a vigorous speech, parts of which are reported as follows:

Mr. Stickney took the ground that the proposed action would amount to nothing and would in no way correct the abuses from which the roads were suffering, because the chairman would not be able to secure sufficient evidence to convict a road of violation of agreement. The present demoralization was due to the dishonesty of officials and the wilful way in which they had violated the law. Not a road in the association had complied with the law since its adoption. Instead of conspiring to evade the law the railroad officials should band together and prosecute any road guilty of violating its provisions. The chairman could not compel railroad officials to furnish him with the evidence necessary to convict a road of wrong doing; the Inter-state Commerce Commission was the proper authority to investigate such charges. It would have no difficulty in finding out that secret rebates, drawbacks or other inducements were given to favored shippers, that tickets were placed in the hands of scalpers to be sold at cut rates and other illegitimate and illegal

practices. These methods could not be estopped except by prosecuting the guilty parties before the Inter-state Commission. If the railroads failed to take concerted action to bring about a strict compliance with the law he, for one, proposed to bring individual action before the Commission against the parties be found violating the law.

Mr. Stickney read the draft of charges against a number of roads for violation of the law, which he proposed to bring to the attention of the Commission, and he would appear before it as public prosecutor. His principal charge was that, instead of publishing and posting all tariffs in pica type, and giving ten days' notice of a change in rates, changes were being made without previous notice being given, and instead of publishing and posting notice as required by law they simply posted a written or hectographic copy in some out of the way place. Thus, if a road desired to take a large shipment at reduced rates it posted such clandestine notice in some unapproachable place, and at the same time gave the required 10 days' notice of an advance. At the expiration of the 10 days the freight on which the cut rate had been made was all disposed of and the road would again charge tariff rates until another opportunity presented itself to take away a large amount of business from a competitor. * *

South Carolina Legislation.

The South Carolina Legislature has passed an act making valid all township bonds issued in aid of railroads, but providing that taxes for the interest on these bonds shall not be levied until the roads have been completed through the townships. This act is a substitute for the bill passed by the Senate, which provided that each township should decide by its own vote whether or not to make valid its bonds. The act giving the Railroad Commissioners absolute power to fix and regulate all freight and passenger rates was passed in spite of vigorous remonstrances from railroad men. Under the new law the Commissioners are to be elected by the Legislature for six years, the first election taking place in November next. The railroads have the right of appeal to the Circuit courts. The bill which passed the Senate last week prohibiting the consolidation of railroads without special permission of the Legislature did not become a law.

L. C. L., O. R., P. P., D. 1.

The important announcement is made that a new rate of $8.40 per 100 lbs. is now in effect on transportation of Chinese skeletons from New York to San Francisco. They must, however, be sent at "owner's" risk and the charges prepaid. A Western paper thus speculates on the possibilities involved in this action: This places it within the power of the Celestials of limited means, by forming clubs, to insure the return of their bones to the Flowery Kingdom even from the remote East. * * A rush of Celestials to the East may now be looked for, as the average skeleton of an adult Chinaman weighs about twelve pounds, and by entering into clubs of eight, it will cost each individual but a dollar to get his bones to the Pacific Coast, from which the steamship rate is very low to Yokohama or Hong Kong. The reduction will give New York a great boom in 1889.

Must Pass Without Stripping.

Referring to the project for a fresh water canal from Denver to the Atlantic seaboard, a Kansas paper consolingly remarks: There is no danger, however, of the scheme seriously crippling the movement for a deep water harbor on the Gulf coast as it will require a great many years to complete the tunnel under the Alleghenies, through which ocean steamers could pass without stripping.

Concerning Strikes.

The Railroad Commissioners of Kansas, in their annual report, speaking of the Santa Fe strike, make the following general observation on the subject: "Any labor organization or combination of employés engaged in the business of transportation or other industrial enterprise, in the carrying on of which the public is more or less directly interested, who strike and attempt to arrest the operation of such work without first submitting to the public a clear and candid statement of grievances, and inviting its opinion thereon, commits a serious mistake. The public is disposed to give indulgent consideration to the rights and interests of workingmen. Moreover, railroads are dependent upon the patronage of the public for their support, and this, together with the fact that their value and usefulness are liable to be affected at any time by legislation, renders them peculiarly sensitive to public opinion. But it is rare that public sympathy for workingmen can be so far led astray as to be enlisted in the support of a cause that has no reasonable foundation of justice. It has been made clear by the sequence of past strikes that one involving great and varied interests cannot succeed unless it has a firm basis of support in public opinion."

A Chinese Passenger Agent.

"Charley Sloan" is the very American name under which "a cute Chinaman, dressed in a most careful manner," appears as a railroad passenger agent in Los Angeles, Cal. "He was," says a local paper, "attired in American costume, and from the crown of his head to the soles of his feet looked a good deal neater than 75 per cent. of the individuals that one encounters on the street. He carried a gold-headed cane in his well-gloved hands, and a diamond glittered in the black cravat which adorned an immaculate shirt collar. He is remarkably intelligent in conversation and gives his opinions on business matters as clearly as if he were born and educated under the Stars and Stripes. He was for a good many years in the General Passenger Office of the Union Pacific at Omaha and has been transferred to Southern California, where he will handle the Chinese passenger business He is as wide awake as any man in the profession."

The Congo Railroad.

The latest news from the engineers who have been surveying a route for the Congo railroad, is that they expected to complete their work about the middle of last month. Three weeks ago a meeting of the Congo company for commerce and industry at Brussels was informed by its manager that, as soon as estimates and plans for building the road could be prepared, the proposition would be submitted to begin at once the work of construction. A map showing the route surveyed to within 60 miles of Stanley pool was exhibited. In order to avoid the mountainous lands which extend almost unbrokenly along the river in the cataract region, it was found necessary to lay the route for the most part about 30 miles south of the river. Except for about 10 miles at the outset the construction of the road will present no difficulties. Only two or three bridges of considerable size will be required, and most of the road will be built through a comparatively level country.

Railroad Detectives.

A St. Louis dispatch states that the secret service department of the Missouri Pacific, in charge of Detective T. J. Furlong, will be abolished Jan. 1. General Manager Clark has been opposed to the continuance of this branch of the service, and has now, it is asserted, ordered it abolished. The expense of the office has been large, estimated at $50,000 per year; but Detective Furlong claims that the service has saved at least half a million a year to the company.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Bell's Gap, annual, 5 per cent., payable Jan. 1.
Cheshire, 3 per cent.
Chicago, Rock Island & Pacific, quarterly, 1 per cent., payable Feb. 1.
Chicago, St. Paul, Minneapolis & Omaha, 1 per cent., on preferred stock, payable Jan. 21.
Evansville & Terre Haute, quarterly, 1¼ per cent., payable Jan. 21.
Long Island, 1 per cent., payable Feb. 1.
Missisquoi Valley, 2 per cent.
New York Central & Hudson River, quarterly, 1 per cent., payable Jan. 15.
St. Louis, Alton & Terre Haute, 1 per cent., on the preferred stock, payable Jan. 10.
St. Paul, Minneapolis & Manitoba, 1½ per cent., payable Feb. 1.
Worcester, Nashua & Rochester, 3 per cent., payable Jan. 2.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Boston & Lowell, annual meeting, Boston, Jan. 2.
Boston & Maine, special meeting, Lawrence, Mass., Jan. 2.
Brooklyn Elevated, annual meeting, 31 Sands street, Brooklyn, Jan. 2.
Carthage & Adirondack, special meeting, 160 Broadway, New York, Jan. 23.
Cleveland & Pittsburgh, annual meeting in the office of the company in Cleveland, O., Jan. 2, 1889.
Knoxville & Ohio, annual meeting, Knoxville, Tenn., Jan. 21, to consider the question of approving the lease of the Knoxville & Ohio to the East Tennessee, Virginia & Georgia, heretofore made in accordance with resolutions adopted by the board of directors.
Lehigh Valley, annual meeting, Philadelphia, Jan. 15.
Loyalsock, annual meeting, Philadelphia, Jan. 14.
Mine Hill & Schuylkill Haven, annual meeting, Philadelphia, Jan. 14.
Montpelier & White River, annual meeting, Barre, Vt., Jan. 10.
Morris County, annual meeting, Paterson, N. J., Jan. 7.
New York, Ontario & Western, annual meeting, 16 Exchange Place, New York, Jan. 16.
North Pennsylvania, annual meeting, Philadelphia, Jan. 14.
Pennsylvania & New York Canal & Railroad Co., annual meeting. Philadelphia, Jan. 14.
Philadelphia & Reading, annual meeting, Philadelphia, Pa., Jan. 14.
Pittsburgh & Lake Erie, annual meeting, Pittsburgh, Pa., Jan. 22.
Western New York & Pennsylvania, annual meeting, Philadelphia, Jan. 14.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The Association of American Railway Accounting Officers meets at the Southern Hotel, St. Louis, Mo., Jan. 24, 1889.

The *American Association of Railway Chemists* will hold its next meeting in Baltimore, Md., Jan. 14, 15 and 16.

The *National Association of Railway Surgeons* holds its annual convention in St Louis, Mo., May 2, 1889.

The *New England Railroad Club* meets at its rooms in the Boston & Albany passenger station, Boston, on the second Wednesday of each month.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month at its rooms in the Phenix Building, Jackson street, Chicago, at 2 p. m.

The *New York Railroad Club* meets at its rooms, 113 Liberty street, New York City, at 7:30 p. m., on the third Thursday in each month.

The *Central Railway Club* meets at the Tifft House, Buffalo, the fourth Wednesday of January, March, May, August and October.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month at the House of the Society, 127 East Twenty-third street New York.

The *Boston Society of Civil Engineers* holds its regular meetings at its rooms in the Boston & Albany station, Boston, at 7:30 p. m. on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at its hall, No. 67 Washington street, Chicago, at 7:30 p. m., on the first Tuesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in St. Louis on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the house of the Club, 1,122 Gerard street, Philadelphia.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7.30 p. m. at its rooms in the Penn Building, Pittsburgh, Pa.

The *Engineers' Club of Kansas City* meets at Kansas City, Mo., on the first Monday in each month.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7.30 p. m. on the third Saturday in each month.

American Society of Civil Engineers.

The thirty-sixth annual meeting of the Society will be held in New York, on Wednesday, Jan. 16, 1889, at 10 o'clock.

The annual reports will be presented, officers for the ensuing year elected, time and place for the next annual convention considered, reports of standing committees presented, and other business transacted.

It is expected that the business of the meeting will be transacted during the first day; a lunch will be served at the society house. Arrangements for the evening of Wednesday, Jan. 16, and for the day and evening of Thurday, Jan. 17, will be perfected by a committee, and will include visits to points of interest, and a dinner or social reception.

Civil Engineers' Society of St. Paul.

The Civil Engineers' Society of St. Paul held a regular meeting Nov. 5. Mr. Estebrook read a paper on the Artesian Wells of St. Paul and Vicinity, and presented blue prints showing their location, and a profile giving depth, elevation of ground surface, height of water and information relating to the strata passed through. The wells vary from 200 to 1,600 feet in depth; but few are flowing wells; in the larger number of them water has to be pumped.

Dec. 3 a meeting was held, and a paper by Mr. S. D. Mason was read on the history of a high viaduct, built in 1883 and 1884 by the Northern Pacific over Mount Gulch. The height at the centre is 16 2ft. The timber was cut and sawed near the spot; the iron and other supplies were hauled 80 miles. This was afterward replaced by an iron viaduct from designs by Mr. George S. Morison, C. E. The paper was illustrated by photographs of both structures and prints of working drawings.

Engineers' Club of St. Louis.

The club met Dec. 19, 1888, at 8:10 p. m., President Holman in the chair, 37 members and 3 visitors present.

The result of the election for officers was announced as follows: President, Edward D. Meier; Vice-President, Francis E. Nipher; Secretary and Librarian, Wm. A. Bryan; Treasurer, Charles W. Melcher; Directors, M. L. Holman, Jas. A. Seddon; Member Board of Managers of the Association of Engineering Societies, J. B. Johnson.

President Holman appointed Robert Moore and R. E. McMath a committee to escort the new President to the chair. Colonel Meier on taking his seat thanked the club for the honor conferred upon him, and called on the retiring President for some remarks appropriate to the occasion. Mr. Holman, retiring President, stated that the amount of work that had recently devolved upon him had made it impossible for him to prepare a formal address. He called attention to the need of a permanent meeting place in a more central location. He also referred to the desirability of a national organization of engineering societies.

Mr. Isaac A. Smith then read a paper "Changing the Gauge of the Ohio & Mississippi Railway." This work was done in the spring and summer of 1871. The length of main line from Cincinnati to East St. Louis was 340 miles, branches, 52; total, 392. The original gauge of 6 ft. was changed to 4 ft. 9 in. A detailed description of the various steps of the work was given. Preparations were carried on for four months, and on Sunday, July 23, each rail was moved 7½ in., preserving the old centre line of track. Two thousand seven hundred and twenty men were employed, and the cost was $25,000 on the track alone. In the discussion Mr. Smith gave a further description of the measuring wheel used and the method of checking its accuracy. The same wheel was afterwards used on the New York Central road. So far as known this was the first 6-ft. road changed. Mr. Robert Moore stated that the old North Missouri road was changed about 1868, and the Missouri Pacific in 1869; neither, however, were 6-ft. roads. Professor Nipher stated that the Denver & Rio Grande road planed its ties preparatory to changing its gauge, by means of a revolving cutter attached to a locomotive. By this means five miles per hour were covered. Robt. Moore thought it unnecessary to have moved the bridge stringers, 6 ft. apart being now considered good practice. Mr. Smith, in reply, stated that at that time it was customary to place ties much further apart than now, for which reason it was unsafe to leave the stringers unchanged.

There was also some general discussion regarding the method of altering the locomotives. It was stated that new fire-boxes had to be built 15 in. narrower, and the axles shortened that amount.

In the general discussion, Mr. Seddon asked for information regarding the action of asphalt under water—whether the asphalt affected the water or vice versa. Mr. Holman stated, in reply, that the coating applied to cast-iron water pipe affected the water while fresh, but the water itself had no effect on the coating. He stated further that he was investigating the deterioration of buried cast-iron; the results of his investigations would be reported to the club later.

Information being asked for as to the present status of the Cullom-Breckenridge bill, Mr. McMath stated that there had been no recent progress, and that there was still a deficiency of $9 in the committee's funds.

President Meier called the club's attention to the proposed monument to Captain Eads. In his opinion it was very desirable that the Engineers' Club of St. Louis should inaugurate a movement in this direction. A committee consisting of Colonel Meier and Professor Engler was appointed to look into the feasibility of erecting such a monument.

Northwest Railroad Club.

The meeting of the Northwest Railroad Club to adopt a constitution and elect officers for the ensuing year was held at the Ryan Hotel, in St. Paul, on Saturday, Dec. 15. Mr. W. T. Small, temporary president, not being present, Mr. W. T. Reed was elected to preside over the meeting. The proposed constitution was read and adopted.

It is in part as follows:

The objects of this association shall be: The promotion of good fellowship among railroad men. The advancement of knowledge relating to the construction, repair and inspection of all classes of railway equipment and railway appliances by discussion in common, investigations and the reports of the experience of its members. To help to bring about uniformity and interchangeability in the parts of railway rolling stock and improve their construction. To adjust the mutual interests growing out of their interchange and repair and inspection rules.

Any one having the supervision of the construction or repair of railroad equipment may become a member; also any one who is or has been connected with the railroad service or any agent or dealer in railroad supplies.

Regular meetings shall be held on the fifth day of each month, at 7.30 p. m., except when the fifth shall be a Sunday, when the meeting will be held on the 4th day of the month; but no regular meeting shall be held in the months of June, July and August.

No patentees or their agents, nor any agent for the sale of railroad supplies, shall occupy the attention of the meeting, with matter pertaining to the article which they represent or handle, unless they are specially invited to do so.

The officers elected were as follows: *President*, W. T. Small, Supt. M. P. & R. S., North Pacific; *First Vice-President*, W. T. Reed, Supt. M. P. & R. S., C., St. P. & K. C. R.R.; *Second Vice-President*, G. F. Wilson, M. M., M. & St. L. R. R.; *Secretary*, H. P. Robinson, editor of the *Northwestern Railroader; Treasurer*, H. L. Preston, M. C. B., C., St. P., M. & O. R. R.

The subject for discussion at the next regular meeting is "Snow Plows and Flangers; the best form and manner of applying and operating."

PERSONAL.

—Wallace W. Hill, Secretary of the Louisville Southern, has tendered his resignation.

—Mr. Walter D. Gregory has resigned the position of chemist of the New York, Lake Erie & Western.

—Master Mechanic Timothy Dickinson, of the Brooklyn, Bath & West End, received a Christmas gift of a gold watch from friends on the road.

—Mr. J. P. Nelson has been appointed Chief Engineer in charge of Maintenance of Way of the Eastern Division of the Newport News & Mississippi Valley Co.

—J. T. Harmer, Assistant General Auditor of the Atchison, Topeka & Santa Fe road, has resigned, to take the position of Auditor of the Elgin, Joliet & Eastern road, with office in Chicago.

—Col. J. Hanson Thomas, Treasurer of the Florda Railway & Navigation Co., died suddenly of pneumonia at Jacksonville, Fla., Dec. 20. Colonel Thomas had held this position about four years.

—The resignation of Mr. H. J. Page as General Freight Agent of the Cincinnati, Indianapolis, St. Louis & Chicago is announced. It is stated that he has been tendered the position of Traffic Manager of the Chicago Belt road. Mr. Page has been connected for 25 years with the "Big Four" road.

—S. F. Boyd, until last spring General Passenger Agent of the Minneapolis & St. Louis road, and now General Passenger Agent of the Duluth, South Shore & Atlantic, will return to the former road Jan. 1 and resume the duties of his old position, vice E. A. Whitaker, who has resigned on account of ill health.

—George H. Russell, Secretary and Treasurer of the Cleveland, Columbus, Cincinnati & Indianapolis, and the Indianapolis & St. Louis roads, died Dec. 22, at his home in Cleveland, after a protracted illness. He was born in Adams, N. Y., in 1817, and entered the railroad service Feb. 1, 1857, as Secretary of the Cleveland, Columbus & Cincinnati. Since 1862 he has been continuously both its Secretary and Treasurer.

—Mr. W. B. Doddridge, Superintendent of the Missouri Pacific lines in Kansas and Nebraska, has been appointed General Manager of the St. Louis, Arkansas & Texas. He is succeeded on the Missouri Pacific by C. M. Rathburn. Mr. Doddridge entered railroad service in 1866 as a telegraph operator, and a year later became an employé of the Union Pacific. He served that company until 1878, when he was appointed a Division Superintendent. In 1882 he was appointed General Superintendent of the Idaho division, and in 1887 he was transferred to the Central Branch, Union Pacific. Since June, 1887, he has been with the Missouri Pacific.

—Mr. John B. McDonald, the well-known contractor and builder of the approaches to the Arthur Kill bridge, has been elected President of the South Baltimore Car Works. Mr. Thomas Deford has been Acting President since the resignation of Mr. William Keyser, last month. The company has on hand orders for 200 gondolas and 150 box cars, and the prospect of business for the coming year is very encouraging. So far this year the company has built and delivered 1,500 freight cars, and the works have been in active operation ever since they started.

Mr. John B. McDonald is 46 years old, and a member of the firm of Ryan & McDonald, one of the largest railroad contractors in the United States. They have a large manufactory of railroad supplies at Waterloo, N. Y., besides large plant at other places. Among their contracts was the building of the Philadelphia division of the Baltimore & Ohio.

ELECTIONS AND APPOINTMENTS.

American Midland —G. W. Ettenger has been appointed Purchasing Agent, with office at 115 Broadway, New York. W. Thorpe is President of the company, with office at 42 New street.

Atchison, Topeka & Santa Fe.—The following appointments, to take effect Jan. 1, have been announced: H. U. Mudge, Assistant Superintendent, to be Superintendent of the Rio Grande Division from Wallace, N. M., to El Paso, Tex., including the Magdalena, Carthage and Silver City branches, with headquarters in San Marcial, N. M.; C. B. Cox, Chief Trainmaster; H Strinrain, Chief Train Dispatcher, and C. H. Crow, Assistant Train Dispatcher.

Barre.—F. W. Stanyan has been appointed Acting Superintendent and General Freight and Passenger Agent of the road, with headquarters at Barre, Vt.

Cordele, Waynesville & South Brunswick.—The incorporators of this company are: M. P. King, H.R. Lymans, W. F. Perriman and others.

Decatur & East St. Louis.—Judge Allen, of the United States Court at Springfield, Ill., has appointed the Central Trust Co., of New York, trustee of the road, under a certain mortgage, in place of Isaac H. Knox, of New York, recently deceased.

Denver, Clear Creek & Western.—The incorporators of this Colorado company are: Sylvester T. Smith, Walter S. Cheesman, J. W. Gilluly, William H. Griffith and Harlan P. Parmelee. The directors are: David H. Moffat, Sylvester T. Smith, Walter S. Cheesman, J. W. Gilluly and A. S. Hughes.

Denver, Texas & Fort Worth.—The newly elected board of directors of the road are: T. W. Pearsall, J. T. Granger and Alexander J. Mayer, of New York; W. T. Walters, of Baltimore; Morgan Jones, J. P. Smith, William M. Harrison, W. F. Summerville and J. M. Brown, of Forth Worth.

Galveston Western.—The Galveston Co. has organized by the election of the following officers: President, J. C. League; Vice-President, J. C. Wallis; Secretary and Treasurer, W. L. Moody; directors, B. Adoue, J. D. Rogers, Frank Lee and Walter Gresham.

Gulf, Houston, & Rio Grande.—The adjourned meeting of the directors was held in Houston, Tex., Dec. 20. The following officers were elected: President, P. W. Smith, of Boston; Vice-President, J. C. Reiff, of New York; Treasurer, J. W. Porter, of Boston; Secretary, J. A. Smith, of Houston. The following Executive Committee was chosen: P. W. Smith, J. Porter, of Boston, and J. C. Reiff, of New York.

Lehigh Valley.—Calvin Pardee has been elected a director by the board of directors, to fill a vacancy.

Los Angeles & Eastern.—The incorporators of this California line are: W. B. Brown, J. M. Brooks, W. B. Nesbitt, T. J. Cuddy and Thomas J. Rusk.

Louisville & Nashville.—H. Frazier has been appointed Roadmaster of the South & North and Birmingham Mineral divisions of the line. H. F. Baldwin, the former Roadmaster, is transferred to the Louisville, Cincinnati & Lexington division, with office at Louisville.

Mann's Boudoir Car Co.—F. H. Crane, Division Superintendent of the Woodruff Sleeping & Parlor Coach Co., has also been appointed Superintendent of the Western Division of this company, with headquarters at Chicago, vice E. B. Lyon, transferred to the Southern Division, with headquarters at Ludlow, Ky., vice William B. Pettit, transferred to the Southern Division of the Union Palace Car Co.

Mineral Range.—The stockholders of the road met in New York last week and elected the following directors: Sidney Dillon, Russell Sage, Henry F. Shoemaker, Rush Taggart, Charles W. Cass, E. L. Terry, Costello Lippit, Charles Bard, T. Chapman and W. J. Smith. The new board of directors organized by electing Henry F. Shoemaker President, and John Tully Secretary and Treasurer.

Minneapolis, St. Paul & Southwestern.—The President of this company is C. C. Garland, of Minneapolis, Minn., and the Chief Engineer is F. D. Woodbury, of Waseca, Minn.

Missouri Pacific.—C. M. Rathburn, Superintendent of the Western Division of the Atchison, Topeka & Santa Fé, will succeed W. H. Doddridge as Superintendent of the lines in Kansas and Nebraska.

New Orleans, Fort Jackson & Grand Isle.—The incorporators of this Mississippi road are: M. J. Zuntz, Theodore Wilkinson, P. F. Herwig, Bradish Johnson, Henry C. Warmoth, Angelo Socola, Joseph H. Hynson and William S. Reddick.

Newport News & Mississipi Valley Co.—J. P. Nelson has been appointed Chief Engineer in charge of Maintenance of Way, with headquarters at Lexington, Ky. As already announced, the company has established its offices independently of the Chesapeake & Ohio, and Mr. H. W. Fuller's connection as General Passenger Agent of the Eastern Division will cease with Dec. 31. W. W. Monroe, in addition to his duties as General Freight Agent, has been appointed General Passenger Agent, with headquarters at Lexington, Ky. The office of General Baggage Agent will be abolished, and all matters pertaining thereto should be addressed to Mr. W. W. Monroe, General Passenger Agent.

New York, New Haven & Hartford.—The annual meeting of the stockholders of the road was held last week in New Haven. The directors of last year, George N. Miller, W. G. Hunt, E. H. Trowbridge, William D. Bishop, Nathaniel Wheeler, Henry C. Robinson, Edward M. Reed, George H. Wancus, Charles H. Clark, Joseph Park, Chauncey M. Depew, H. S. See and William Rockefeller, were re-elected.

Northern Pacific.—At a meeting of the directors of the road last week, the resignation of Edwin H. Abbott was accepted, and W. L. Bull was elected to fill the vacancy.

Ohio Valley Railway & Terminal Company.—The incorporators are Charles Viele, John Ingle, Madison J. Bray, Jr., Jordan Giles, R. H. Ingram, J. B. Montgomery, and J. F. Clay.

Philadelphia & Erie.—The directors of the road have elected Amos R. Little and J. Bayard Henry directors, to fill the vacancies caused by the resignation of Edmund Smith and the death of John Price Wetherill.

Rockaway Valley.—The following officers were chosen at the first annual meeting: President, J. N. Pidcock; Superintendent, James Sayre; Secretary and Treasurer, J. B. Fisher; Chief Engineer, J. E. Melick.

San Francisco & North Pacific.—Frederick F. Low, Samuel G. Murphy, George W. Prescott, Philip N. Laventhal, Louis Sloss, William F. McAllister and Solon Pattee are the board of directors of the new company.

Southern Pacific Co.—Frank Dillingham is now Commercial Agent of the Atlantic system of the Southern Pacific Co. and the Houston & Texas Central Co., with headquarters at Denver, Colo.

Temiscouata.—The annual meeting of the shareholders of the company was held at River du Loup last week, when A. A. McDonald was appointed President; Hector Cameron, Vice-President; John J. McDonald, Managing Director, and S. J. Miller, General Manager.

Toledo, Ann Arbor & North Michigan.—A. J. Pessley has been appointed General Passenger Agent, to take effect Jan. 1. M. H. Bennett remains General Freight Agent.

Union Palace Car Co.—The following appointments have been made: Major John C. Paul, General Manager of the Woodruff Sleeping & Parlor Coach Co. and Assistant General Manager of Mann's Boudoir Car Co., has also been appointed General Manager of this company and will have general charge of the Operating Department. Wm. B. Pettit has been appointed Superintendent of the Southern Division of the company, with headquarters at Washington, D. C.

Zanesville & Ohio River.—George F. Gardner, Assistant Superindent, has been appointed Superintendent of Transportation, to take effect Jan. 1, with office at Zanesville, O.

OLD AND NEW ROADS.

New Companies Organized.—Cordele, Waynesville & South Brunswick.—Denver, Clear Creek & Western.—Los Angeles & Eastern.—Nebraska, Dakota, Wyoming & Pacific.—New Orleans, Fort Jackson & Grand Isle.

Alabama Midland.—J. M. Brown & Co., of New York, the general contractors for this road, have sublet the contract for grading the road from Bainbridge, Ga., to near Montgomery, Ala., 175 miles, to Louis McLain, of Sanford, Fla. About 220 teams and 1,200 men are at work, and it is expected to complete the line by Aug. 15 next. The contract for tracklaying has been let to H. C. Griffin & Co.

Americus, Preston & Lumpkin.—This Alabama road is now being changed from three ft. to standard gauge. The name of the road will probably soon be changed to Savannah, Americus & Montgomery. The proposed extension from Louvale, Ala., near the Chattahoochie River has now been surveyed to Montgomery, a distance of about 100 miles.

Augusta & Southeastern.—Work has been commenced on this extension of the Batesville & Brinkley road and three miles of track have now been laid from Coats, on that line, west toward Lone Grove, Ark.

Baltimore & Drum Point.—The company has contracted for the grading of that portion of their road between Baltimore and Millersville, Anne Arundel County. The work is to commence next month and be completed by July 1. The surveys have been completed for the proposed Washington branch from Conway's, near Millersville, to Washington City.

Birmingham Mineral —The grading of the four-mile Self Creek extension from Palmer to Bradford coal mines, Ala., is about half finished.

Brantford, Waterloo & Lake Erie.—Bids for the construction of this line from Waterford north to Brantford, Ont., a distance of 17 miles, will be received until January 22 next. The tenders may be for the whole work, or exclusive of the ties and rails. George H. Wilkes, Brantford, Ont., President.

Central Washington.—This branch of the Northern Pacific from Cheney to Davenport, Wash. Ter., a distance of 42 miles, has been nearly all completed, and will be ready for operation by Jan. 1. S. W. Hunt was the contractor.

Chicago, Kansas & Nebraska.—Dispatches state that engineers are now surveying an extension of the line to Liberal, Kan., south from that point through the Indian Territory toward El Paso, Tex.

Chippewa Valley.—The company has completed arrangements for the control of the Carey & Manistee narrow gauge road, between Carey and Manistee, Mich. The road will be made standard gauge and extended south.

Cordele, Waynesville & South Brunswick.—A charter has been granted in Georgia to this company, organized some time since to build a road between Cordele and Waynesville to South Brunswick. The capital stock is, $1,875,000. It is thought that work on the road will be commenced early next year.

Cornwall & Lebanon.—The engineers have completed a second survey for the proposed extension to connect with the Schuylkill Valley branch of the Pennsylvania. The first line connecting at Reading has been abandoned, owing to the mountainous character of the country near Reading. The last line surveyed starts from Cornwall, passing along the north side of the South Mountain to Schaefferstown, then to Kleinfeltersville, thence across to Cocalico, Blainsport, Denver, Binmansville, Gibraltar and Birdsboro, when it will form a connection with the Schuylkill Valley. Another experimental line will now be run, after which the road will be definitely located.

Denver, Clear Creek & Western.—A company has been incorporated in Colorado to construct a road from a point on the Denver & Rio Grande at or near Petersburgh, thence northwesterly to Golden, and up Clear Creek cañon to Georgetown, Black Hawk and Central City. The capital stock is $500,000.

Denver & Rio Grande.—The contract for the Lake City branch of the road, mentioned last week, was let to Scullin & Stacey.

Fort Worth & Rio Grande.—The company is filing for record in Texas a copy of a mortgage made to the Central Trust Co., of New York, to secure bonds to be issued at the rate of $20,000 to the mile on the main line and branches from Fort Worth to Kerrville, in Kerr County.

Grand Rapids & Indiana.—The company has sold its entire land grant in Misaukee County, Mich., comprising a tract of 5,000 acres, to John Torrent, the well-known Muskegon lumberman, for $800,000. The tract is estimated to contain 2,000,000 feet, and the contract requires Mr. Torrent to turn the logs into lumber at Lake City, the county seat, and give the railroad the transportation of it to market. The people of Lake City have agreed to give Mr. Torrent $25,000 in village bonds and 40 acres of land. Mr. Torrent, on his part, agrees to build a large saw and planing mill.

Hawesville & Pellville Mineral.—President D. L. Adair, of this proposed road, to run from Hawesville, Ky., to Pellville, Ky., a distance of 14miles, announces that the survey has been begun and that he will begin the work of construction about Jan. 15.

Lake Erie, Essex & Detroit River.—The road is now completed between Ruthven and Walkerville, via Harrow and Kingsville, in Western Ontario. The road is 30 miles long.

Los Angeles & Eastern.—The company has filed articles of incorporation in California, with a capital stock of $3,000,000, of which $125,000 has been subscribed.

Louisville & Nashville.—The company has ordered a survey made at once for a branch road 3½ miles in length, from the main line at Shelby City, Ky., to Danville, Ky., and work will be begun at once. Citizens of the latter place requested that the branch be built, and offered a good sum if the work were commenced at once.

Manitoba & Northern Pacific.—The Supreme Court of Canada last week gave judgment in the case of Manitoba vs. the Canadian Pacific, maintaining that the Province is right in the position taken, and that the Manitoba & Northern Pacific can cross the Canadian Pacific track. The judgment was unanimous.

The decision of the Court is as follows: "The question referred to us by the Railway Committee of the Privy Council is as to whether the Provincial government of Manitoba had a right to enact legislation authorizing the Red River Valley Railway to cross the Pembina Branch of the Canadian Pacific road and the Manitoba & Southwestern branch of the Canadian Pacific. In answer to said question, this Court, having heard counsel on both sides, is unanimously of the opinion that said statute of Manitoba is valid and effectual, as to confer authority on Railway Commissioner in said statute of Manitoba mentioned to construct a railway as the Portage extension of the Red River Valley Railway crossing the Canadian Pacific Railway, the Railway Committee of Privy Council first approving of the mode and place of crossing and first giving their directions as to the matters mentioned in the railway act."

Minneapolis, St. Paul & Southwestern.—The preliminary survey for this road is completed for about two-thirds of the distance from Minneapolis to Kansas City, between which points the road is chartered to run. The survey for the rest of the distance is progressing rapidly, and it is thought that contracts for building part of the road will be let next spring or summer. F. D. Woodbury, of Waseca, Minn., is Chief Engineer.

Missouri, Kansas & Texas.—Judge Wallace, in the United States Circuit Court at New York, last week confirmed the report of Samuel A. Blatchford, Master in Chancery, fixing the amounts due to the plaintiffs in the suit of John Sevier and others against this company and the Union and Mercantile Trust companies. The suit was decided in favor of the plaintiffs, and an injunction was granted to prevent the defendants from interfering with the property covered by the first mortgage, or apply the earnings to payments other than the interest on the mortgage until that is paid. To John Sevier is awarded $164,800; to Christian Zabriskie, $35,696; to J. Alfred Davenport, $15,389; to Edward H. Van Winkle, $13,988, and to James Cant, $59,663.

Missouri Pacific.—John Fitzgerald, on behalf of himself and other stockholders of the Fitzgerald & Mallory Construction Co., has filed a suit in Lincoln, Neb., against the company and the Fitzgerald & Mallory Construction Co., praying for an accounting. The amount involved is $1,500,000. The cause of action is based specially against the Missouri Pacific on the work done by the Construction Company in the building of the Denver, Memphis & Atlantic road, in Kansas, and against the Construction Company on account

of alleged frauds and illegal acts committed by members of that company.

Nebraska, Dakota, Wyoming & Pacific.—Articles of incorporation have been filed in Nebraska to build a road from a point at or near Omaha westward to Fort Fetterman, Wy., and thence northwesterly to Dakota. The capital stock is $10,000,000.

New Orleans, Fort Jackson & Grand Isle.—The company has been organized in Mississippi to build a road to extend along the right bank of the Mississippi River between New Orleans and Fort Jackson.

New Roads.—Preliminary surveys have been made, and right of way is being secured for a proposed gravity road at Reading, Pa., over and around Pemis Mount, somewhat similar to the one at Mauch Chunk. An inclined plane is to be built to the highest point of the mountain, which is about 900 ft. above the surface of the Schuylkill River. The cars will be drawn up this distance by steam or electric power, and then run by gravity some 10 or 12 miles around the mountains to the place of starting. Among those interested in the project are Albert Thalheimer, Thomas P. Merritt, Major J. E. Ancona, and others.

New York, New Haven & Hartford.—At the annual meeting of the stockholders President Charles P. Clark made the following statement regarding the application of the company to the Connecticut Legislature for power to increase its capital stock, which we noted last week:

"The company has issued $2,000,000 of bonds at 4 per cent. interest, due 15 years hence. It has a floating debt, payable on short notice, amounting to $2,500,000. This debt has been incurred in the purchase of real estate, in the construction of four tracks through the state of New York, and in adding to the equipment of the road, as set forth in detail in the annual reports. When the bonds were issued provision was made for an additional $3,000,000, which are still available.

"As to the acquirement of lines in which we have a leasehold interest for 50 years, it is for the advantage of all concerned that your property should be unified. When propriety or necessity exists for an improvement upon any part of this property there should be no thought in the minds of its managers as to whether the call comes from a leased line or from the main line. The whole should be as one, separated into divisions for the convenience of operation, but a unit in interest and a common obligation. This cannot be effected by any process of coercion. The market value of both the stocks and bonds of these leased roads is based upon an income of 4 per cent. per annum.

"For the third purpose, provision for the cost of future improvements, the field is unbounded. In the annual reports you will see that the tolls paid for the use of the Harlem road have in 10 years increased nearly 50 per cent. This represents business only upon one end of one division of our road. Who can tell what may be needed in cars and engines, in lands, in tracks, and in buildings during the 10 years to come? We must be ready to do all the business that seeks our lines, and to do it promptly and economically. If this increase is authorized we intend to go on vigorously with the improvements already named. Four tracks are substantially completed through New York state, and within a few days we expect to have the benefit of them. But we must stop four tracking there unless provision is made for paying the bills.

"In all this there is no suggestion of what is commonly called 'water' by a revaluation of the property as a basis for an increase of its stock. Nor is there to be any gleaning or groping through past years to determine what amount of surplus earnings have been invested in the property. Real estate purchased from year to year has increased in value, like adjoining properties, largely by the beneficent influence of the road itself. These values are to remain and abide with its owners as tenants in common. But we must keep abreast of the times and continue to improve our facilities and our service. To this end and for these purposes we shall ask the co-operation of the General Assembly in making our company in fact 'The Consolidated Railroad.'"

Under the law the application for increase of stock must be heard by the Railroad Commissioners, who will report the result with the recommendations to the Legislature for final action.

New York & New England.—It is published that the New York city terminal referred to at the recent annual meeting of the road is to be located on new piers 35 and 36 East River (old numbers, 45 and 46), which have been leased by Mr. J. A. Bostwick, president of the road. It is stated that a large Sound steamer and a transfer boat have been bought, and another transfer boat to carry 19 cars has been ordered, for, or in the interest of, the Terminal company, which the New York & New England and the Housatonic propose to establish for the transportation of freight between Wilson's Point (Norwalk) and New York city.

Ohio & Mississippi.—The company is now making a new survey of the Paducah & Shawneetown road, authorized by an old charter, and it is stated that the road will be built very shortly by the company. It runs from Shawneetown, Ill., to Paducah, Ky., a distance of 56 miles. Some years ago $200,000 was voted the road, but the project was allowed to fall through.

Ohio Valley.—Chief Engineer C. C. Genung has just completed his survey for the new line from Princeton, Ky., to Hopkinsville, Ky., and the work of construction will be commenced Jan. 1. The length of the extension by the survey is 31 miles.

Ohio Valley Railway & Terminal Co.—This company has been organized at Evansville, Ind., for the purpose of constructing a line of railroad three miles in length from the Henderson Bridge Co.'s railroad, in Vanderburgh County, Ind., to a point in the city of Evansville, giving the Ohio Valley road an entrance into that city. The capital stock is $300,000.

Pittsburgh, Cadiz & Ohio.—The company is to be reorganized by Col. Albert E. Boone, of Zanesville, O., and form part of the proposed "Black Diamond System." It will be the fifth road in the system and will be the Pittsburgh outlet. The Ohio River will be crossed at Wellsville, and the line will pass through Cadiz, Freeport, Morgan Junction and Cumberland. In 1853 this route was surveyed from Maysville, Ky., to Pittsburgh, and a large sum spent in grading from McConnellsville to Freeport. Later on the road was built from Cumberland to Morgan Junction.

Pueblo, Gunnison & Pacific.—The preliminary surveys for this Colorado road have just been completed between Pueblo and Gunnison, Col. The line runs in a southwesterly direction from Pueblo to the Green Horn Mountains, crossing the St. Charles River about 15 miles from Pueblo. It then runs due west to Sears, St. Mary's, Badito, Gardner and other towns. The line then crosses the Green Horn range at Medno Pass, and passes through the Seguache Valley.

Richmond & Allegheny.—Judge Welford in the Circuit Court, at Richmond, Va., has issued a decree directing the sale of the road and all its properties and franchises. E. R. Leland, the present Secretary of the company, is appointed Commissioner to effect the sale. The decree specifies that obligations amounting to $1,190,080, consisting of receiver's certificates, Kanawha canal bonds and special liens, are to be primarily satisfied. The first mortgage bonds of the road amount to $500,000, and there is a second mortgage of $4,000,000. The road is 255 miles in length, including branches. The main line extends from Richmond to Clifton Forge, where it forms a junction with the Chesapeake & Ohio. The road was leased by the Chesapeake & Ohio last September, and is now operated by that company.

San Francisco & North Pacific.—The San Francisco & North Pacific Railway Co. has filed articles of incorporation, and proposes to purchase the San Francisco & North Pacific Railroad, the San Francisco & San Rafael Railroad, the Sonoma Valley Railroad, the Cloverdale and Ukiah Railroad and all their branches from Point Tiburon, the present terminus in Mendocino County, and all the rolling stock and ferries connected with the lines. The capital stock of the company is $6,000,000.

Seattle, Lake Shore & Eastern.—The company has selected Mission Station, on Frazer River, 42 miles east of Vancouver, B. C., and 145 miles north of Seattle, as the point of junction of the Northern branch with the Canadian Pacific. The Canadian Pacific builds 15 miles to the boundary, while the balance will be built by this company.

Springhill & Oxford.—This line, which is being built by the Cumberland Railway & Coal Co., of Nova Scotia, has now been completed from Springhill toward Oxford 11 miles, leaving three miles to complete it to the latter point. It connects with the Intercolonial road at Salt Springs, N. S.

Toledo, Ann Arbor & North Michigan.—The extension from Cadillac northeast to Frankfort on Lake Michigan has now been completed to Springville, a distance of 20 miles, and work is in progress on the remaining 41 miles to Frankfort. Next year the company will build a line from Manistee River Junction to Manistee, a distance of 20 miles.

Wabash.—The Masters in Chancery have adjourned until Jan. 7, having taken about all the testimony in the case. They will be prepared at that time with a formal report to present to the Court, which will be then considered by the attorneys on both sides. It is thought that two or three days will be sufficient for the purpose of reaching a final report. It is expected that after the report is made to the Court a decree will probably follow, so that the plan of reorganization is near consummation.

TRAFFIC AND EARNINGS.

Traffic Notes.

The Florida special of the Pennsylvania road will begin its tri-weekly trips on Jan. 7.

The Chicago, St Paul & Kansas City has put on a new line of Mann boudoir cars between St. Paul, Minn., and St. Joseph, Mo. Dining cars are soon to be put upon this route.

The Denver, Texas & Forth Worth has established a freight and passenger agency at Liverpool, England.

Coal.

The coal and coke tonnage of the Pennsylvania originating on lines east of Pittsburgh and Erie for the week ending Dec 1, and the year to that date, was as follows:

	Coal.	Coke.	Total.
Total for week ending Dec. 15.....	236,737	93,570	330,307
Total for year 1888 to date.....	11,189,210	3,944,630	15,133,840
Total for year 1887 to date.....	9,970,006	3,582,293	13,552,299

The anthracite coal tonnage of the Belvidere division of the United Railroads of New Jersey division for the same periods was as follows:

	1888.	1887.	Inc. or Dec.
Total for week.....	38,929	43,308	D. 4,379
Total for year.....	1,617,113	1,513,329	I. 103,784

Railroad Earnings.

BUFFALO, ROCHESTER & PITTSBURGH.

Year to Sept. 30:	1888.	1887.	Inc. or Dec.
Betterments.....	$488,789	$3,427,266	D. $2,938,477
Gross earnings.....	1,925,533	1,830,401	I. 95,132
Oper. expenses.....	1,436,917	1,280,009	I. 156,008
Net earnings.....	$485,616	$550,392	D. $61,776
Other income.....	31,727	75,540	D. 43,813
Fixed charges.....	531,336	453,613	I. 77,723
Def. for year.....	10,992	172,318	I. 183,310
Total def. Sept. 30.....	6,552	sur. 154,440	I. 160,992
Cash on hand.....	31,889	90,330	D. 68,341

NEW YORK, NEW HAVEN & HARTFORD.

The annual report to Sept. 30, as furnished to the New York Railroad Commissioners, is as follows:

Betterments.....	$2,146,408	$672,582	I. $1,473,826
Gross earnings.....	9,766,555	7,724,392	I. 2,042,163
Oper. expenses.....	6,822,528	5,274,709	I. 1,547,819
Net earnings.....	$2,944,026	$2,449,683	I. $494,343
Other income.....	203,481	165,816	I. 37,665
Gross income.....	$3,149,508	$2,615,499	I. $532,009
Fixed charges.....	1,513,788	861,607	I. 652,181
Net income.....	$1,633,719	$1,753,892	D. $120,173
Dividends.....	1,550,000	1,550,000	
Surplus.....	83,719	203,892	D. 120,173
Total sur. Sept. 30.....	3,554,942	3,547,808	I. 7,134
Cash on hand.....	116,507	1,214,828	D. 1,098,321

Earnings of railroad lines for various periods are reported as follows:

	1888.	1887.	Inc. or Dec.
Month of October:			
Den., So. Pk. & Pac.	87,654	$113,246 D.	$25,592 22.6
Net..... def.	14,029	17,794 D.	31,823 ....
Fort. W. & Den. C....	121,446	85,296 I.	35,150 20.3
Net.....	43,628	39,418 I.	4,210 10.7
Louis., N. Alb. & Chi.	229,139	217,369 I.	11,770 5.4
Net.....	104,342	109,715 D.	5,373 4.9
Mexican Central....	451,287	444,216 I.	7,071 1.6
Net.....	215,798	178,210 I.	37,588 21.1
Guadalajara Div..	48,081	.....	.....
Net.....	28,612	.....	.....
San Luis Potosi D.	8,364	.....	.....
Net.....	4,681	.....	.....
Oregon Short Line..	288,485	171,567 I.	116,918 68.1
Net.....	148,906	64,953 I.	83,953 129.1
Scioto Valley.....	61,182	75,802 D.	14,620 19.3
Net.....	14,343	24,543 D.	10,200 42.0
Southern Pac. Co.:			
Pacific System.....	3,427,602	2,783,102 I.	644,500 23.1
Net.....	1,296,701	1,271,091 I.	25,610 2.0
Total of all.....	4,528,751	3,912,714 I.	616,037 15.7
Net.....	1,707,060	1,752,630 D.	45,570 2.6
Ten Months—Jan. 1 to Oct. 31:			
Bur., Ced. Rap. & N.	2,274,025	2,400,998 D.	126,973 52.9
Net.....	539,513	555,561 D.	16,048 3.0
Central of Iowa.....	1,131,733	1,079,421 I.	52,312 4.8
Net.....	61,936	94,882 D.	32,946 34.7
Ches., Ohio & S. W..	1,636,673	1,589,407 I.	47,266 3.0
Net.....	590,153	660,714 D.	70,561 10.7
Chi., Bur. & No.....	1,604,552	1,979,297 D.	374,745 18.9
Net.....	277,838	478,284 D.	200,446 41.9
Ten Months—Jan. 1 to Oct. 31:			
Denver, So. Pk. & P.	918,919	1,096,095 D.	177,176 16.2
Net..... def.	49,656	106,654 D.	156,310 ....
East Tenn., Va. & G.	4,600,627	4,310,561 I.	290,066 6.7
Net.....	1,591,024	1,251,717 I.	339,307 27.1
Ft. Worth & Den. C..	866,794	571,208 I.	295,586 51.7
Net.....	321,451	242,417 I.	79,034 32.6
Kentucky Central...	859,095	884,492 D.	25,397 2.9
Net.....	391,769	375,141 I.	16,628 4.4
Knoxville & Ohio....	410,907	358,711 I.	32,196 8.5
Net.....	169,888	123,506 I.	46,382 37.5
Louis., N. Alb. & C..	1,911,322	1,896,869 I.	14,453 .8
Net.....	703,047	611,785 I.	91,262 14.9
Mexican Central....	4,618,390	3,878,435 I.	739,955 19.1
Net.....	1,788,311	1,676,596 I.	112,715 6.7
Mil., L. Sh. & West.	2,389,143	2,772,216 D.	383,073 13.8
Net.....	932,647	1,157,673 D.	225,026 19.4
Minn. & St. Louis....	1,122,422	1,217,290 D.	94,868 7.8
Net.....	256,952	352,514 D.	95,562 27.1
New Brunswick.....	732,160	677,103 I.	55,057 8.1
Net.....	.....	.....	.....
Ohio River.....	384,340	301,068 I.	83,272 27.7
Net.....	169,794	144,031 I.	25,763 17.9
Omaha & St. Louis..	331,098	351,051 D.	19,953 5.7
Net.....	.....	.....	.....
Ore. Improve. Co....	4,121,288	3,403,250 I.	718,038 21.1
Net.....	900,096	981,097 D.	81,001 8.2
Ore. Ry. & Nav. Co.	5,238,990	4,220,352 I.	1,018,638 24.1
Net.....	1,878,557	1,811,777 I.	66,780 3.7
Oregon Short Line..	2,183,611	1,646,476 I.	537,135 32.6
Net.....	998,818	566,008 I.	432,810 76.5
Rome, W. & Ogd....	2,798,754	2,678,099 I.	120,655 4.5
Net.....	1,197,055	1,197,993 D.	938 .8
Scioto Valley.....	561,639	655,501 D.	93,862 14.3
Net.....	121,676	164,462 D.	42,786 26.0
Southern Pacific Co.:			
Gal., Har. & S. Ant	3,061,598	2,741,098 I.	320,500 11.7
Net.....	729,819	512,757 I.	217,062 42.2
Louisiana West....	785,952	689,034 I.	96,918 14.2
Net.....	380,988	334,184 I.	46,804 14.0
Morgan's La. & Tex	4,057,675	3,509,022 I.	548,653 15.6
Net.....	1,222,137	807,688 I.	414,449 51.3
N. Y., Tex. & Mex.	114,580	141,833 D.	27,253 12.2
Net..... def.	33,788	17,373 D.	51,161 ....
Tex. & N. Orleans..	1,170,329	1,040,047 I.	130,282 12.5
Net.....	323,381	484,872 D.	161,491 33.3
Tot. Atlan. System	9,190,129	8,121,032 I.	969,097 11.9
Net.....	2,622,535	2,156,875 I.	465,660 21.6
Tot. Pacific System	29,361,076	23,284,080 I.	6,076,997 26.1
Net.....	10,743,201	10,555,161 I.	188,040 1.8
Total Company..	38,551,206	31,405,114 I.	7,146,092 22.7
Net.....	13,365,738	12,712,037 I.	653,701 5.1
Wabash.....	5,464,027	5,796,046 D.	332,019 11.9
Net.....	1,053,396	1,903,080 D.	849,684 44.6
Month of November:			
Augusta, Gib. & San.	12,018	9,062 I.	2,956 33.1
Net.....	6,290	3,747 I.	2,543 69.0
Baltimore & Ohio:			
Lines E. of Ohio R.	1,281,049	1,385,137 D.	104,088 7.5
Net.....	421,726	493,451 D.	71,725 13.2
Lines W. of Ohio R	379,253	414,250 D.	34,997 8.4
Net.....	50,653	85,187 D.	34,534 40.5
Total system.....	1,660,302	1,799,387 D.	139,085 7.7
Net.....	472,379	578,638 D.	106,259 18.4
Marietta, Col. & N..	8,113	7,189 I.	924 12.8
Net.....	3,607	3,563 I.	44 1.2
Nash., Chat. & St. L.	261,571	259,625 I.	19,460 7.5
Net.....	107,837	109,905 D.	2,068 2.0
Summit Branch.....	106,765	147,202 D.	40,457 27.5
Net.....	6,536	31,973 D.	25,437 79.5
Lykens Valley.....	83,941	94,872 D.	10,931 11.5
Net.....	520	6,638 D.	6,118 92.7
W. Va. Cent. & Pitts.	60,908	50,296 I.	10,612 21.1
Net.....	18,749	18,665 I.	840 .4
Eleven months—Jan. 1 to Nov. 30:			
Mar., Col. & Northern	$79,645	$63,031 I.	$16,614 26.4
Net.....	34,533	29,007 I.	5,526 19.1
Nash., Chat. & St. L.	2,840,155	2,780,435 I.	59,720 2.1
Net.....	1,164,853	1,241,978 D.	77,125 6.2
Summit Branch.....	1,328,597	1,235,858 I.	92,739 7.5
Net.....	190,573	120,824 I.	69,749 57.7
Lykens Valley.....	929,481	718,859 I.	210,622 29.3
Net..... def.	15,767	def. 99,894 I.	84,127 ....
W. Va. Cent. & Pitts	596,615	369,237 I.	227,378 61.6
Net.....	186,324	125,535 I.	60,789 48.4

Western Rates.

The Western and Southwestern freight agreement goes into effect Jan. 1. It restores all rates. The rates on packing house products and live stock, which have been demoralized for several months, will be advanced to the basis of 25 cents on packing house products and 25 cents on live hogs from Kansas City to Chicago, and 27½ cents and 20 cents respectively from Omaha. It is stated that there are no contracts out which will interfere with this. The rate on lumber from Chicago to Southwestern Missouri River points is advanced 2½ cents to 16 cents. The agreement provides that in addition to the penalty already prescribed any road found guilty of cutting rates shall divide with its competitors the excess of freight earnings accruing to it on that account. It also gives the chairman authority to assess penalties without calling a meeting of the association. In passenger affairs the reports are not reassuring but the Southwestern lines seem to have adjusted their differences and rates will probably be restored Jan. 1. The scalpers have a large number of Wabash tickets from Chicago to Kansas City which they refuse to return at cost price. Receiver McNulta obtained an injunction from Judge Gresham restraining Ticket Broker Frank from selling or disposing of the unlimited tickets in his possession, and it is said that Frank finally agreed to return the entire block, about 1,000. As there are only about seventy limited Wabash tickets in the hands of Mr. Frank, and as these tickets expire before long by limitation, Receiver McNulta did not press the return of the latter. It is stated that the unlimited tickets were sold by the agent without the Receiver's authority.

The Western and Northwestern roads have agreed to restore passenger rates on Jan. 1 from Chicago to Council Bluffs, Omaha, St. Paul, Minneapolis, and Lake Superior points.

ANNUAL REPORTS.

The following is an index to the annual reports of railroad companies which have been reviewed in previous numbers of the current volume of the *Railroad Gazette:*